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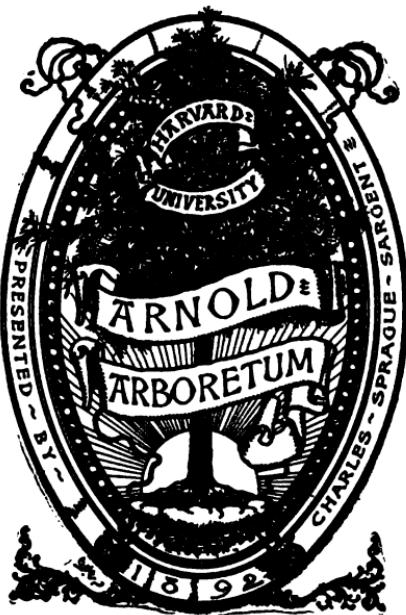
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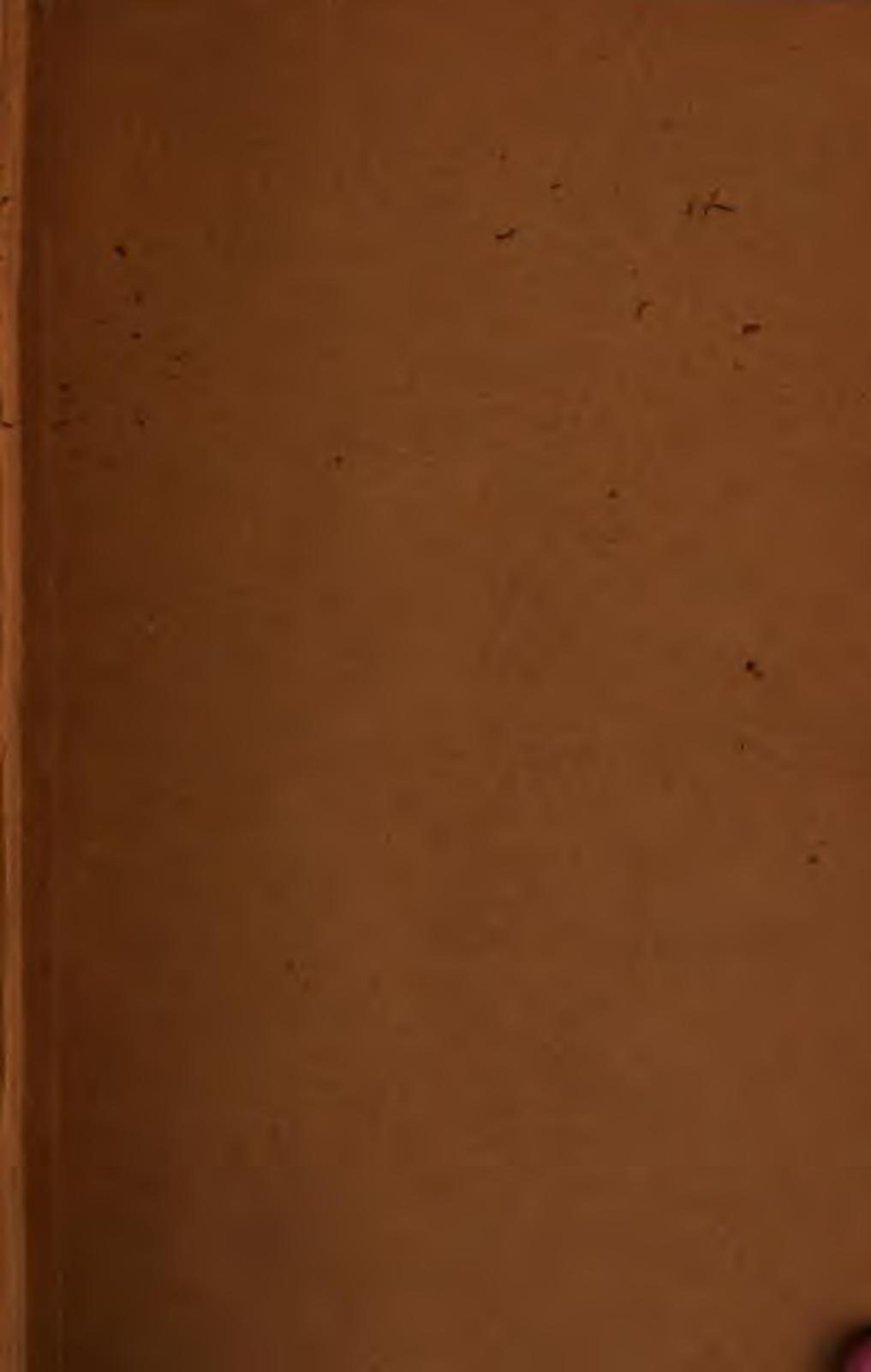
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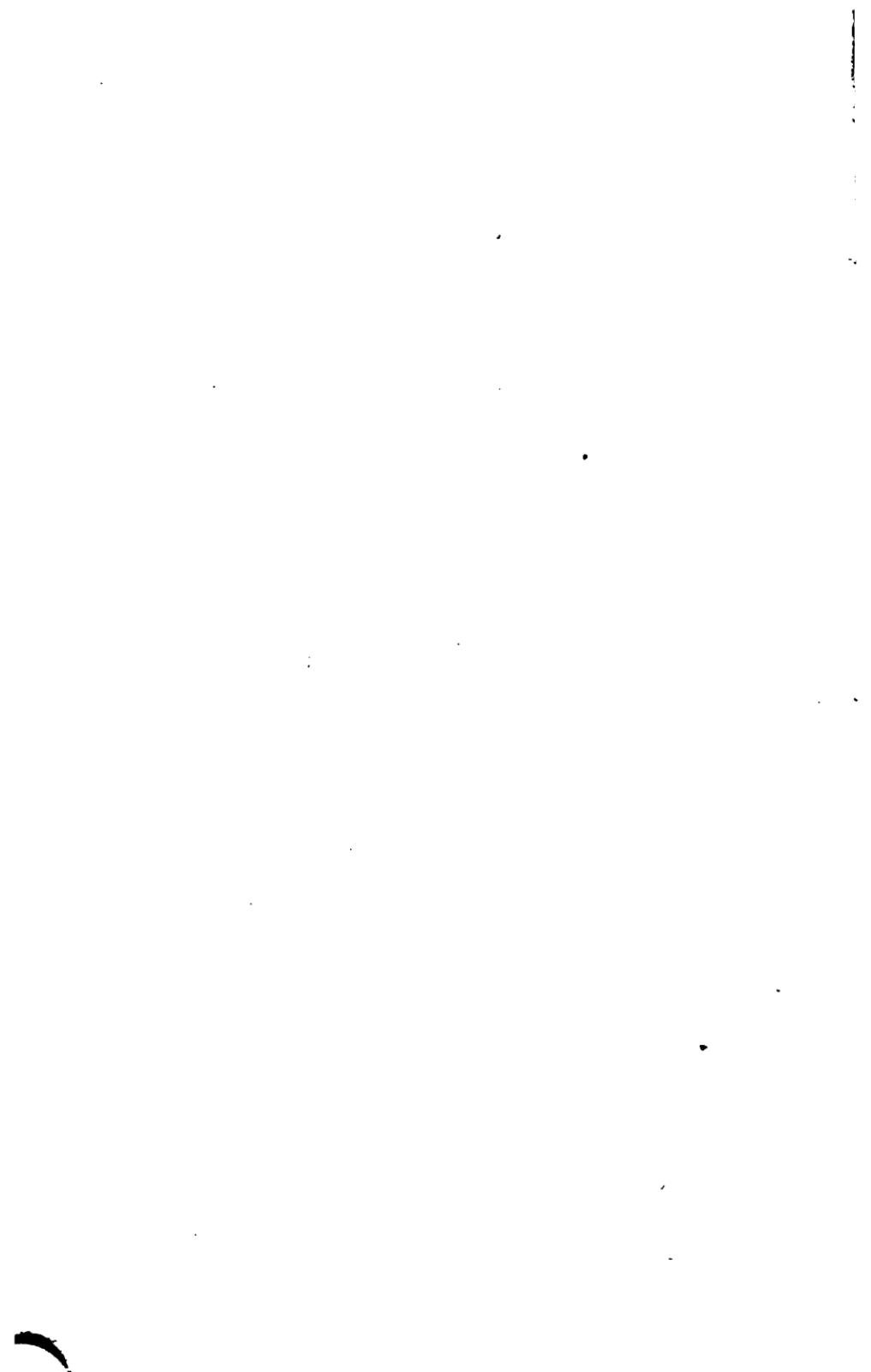
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QUARTERLY
Journal of Forestry.

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INDEX TO VOL. II.

	PAGE
Acorns for Denmark	308
Ardross Woods. Working-plan by W. SCHLICH. Reviewed	75
Ash Underwood converted into High Wood. W. R. Brown	113
Ashton Court. J. P. ROBERTSON	59
 BATHURST, Earl. Woodlands	
Beechwoods, yield of. SIR HUGH BEEVOR	32
Belgium, Planting of Moors and Bogs. A. P. GRENFELL	200
Black Walnut. H. J. ELWES	267
" " A reprint. G. PINCHOT	167
Boulger's "Wood." Reviewed by H. J. ELWES	138
" Notes by G. S. BOULGER	200
"	314
 Chestnut Coppice near Paris. P. M. LEDDET	
Colesborne Woodlands. J. P. ROBERTSON	310
" Notes by H. J. ELWES	39
"	151
Coniferous Timber Crops. Durham, Volume per acre. C. MOISER	175
Connold's "British Oak Galls." Reviewed by W. R. FISHER	297
Conversion of Underwood into High Wood. W. R. BROWN	113
" " " F. A. OSMOND SMITH	154
" " " E. R. PRATT	166
COWAN, B. Obituary Notice	181
 Denmark, Tour of R. E. A. S. E. DAVIDSON	
DUBOIS, A. Obituary Notice	292
"	179
 Elm, Propagation of. F. ARTHUR	
Encyclopædia of Agriculture. SIR HERBERT MAXWELL. Reviewed by W. R. FISHER	210
Entomology, Forest. A. T. GILLANDERS. Reviewed by J. J. WALKER	129, 204
Evelyn's "Sylva." T. NESBIT. Reviewed by W. R. FISHER	197
Excessive Felling in Ireland. A. E. MOERAN	292
Exhibition of Forestry, Lincoln. W. B. HAVELOCK	24
" " Newcastle. A. C. FORBES	116
"	303
Fencing. J. C. ARCHIBALD	250
Forestry Education. Notes from Oxford	80, 309
Forest Garden, R. A. College, Cirencester	37
Forestry in S. Australia.	311
 German Arboriculture. H. J. ELWES	
Girth of Pines and Larch. G. MARSHALL	132
GUEUNING, A. Obituary Notice	213
"	182
 Hainault Forest. A. P. GRENFELL	
Hargham Woods. SIR HUGH BEEVOR	109
High Meadows Wood. A. P. GRENFELL	298
Holkham Sand Dunes. D. MUNRO	109
Honours to Members of R. E. A. S.	103
"	79
 Indian Forester. Reviewed by W. R. FISHER	
Indian Forest Zoology. E. P. STEBBING. Reviewed by W. R. FISHER	214
" Utilization. R. S. TROUP. Reviewed by W. R. FISHER	285
"	126

Index to Vol. II.

	PAGE
Injurious Insects in Midlands. W. E. COLLINGE. Reviewed by W. R. FISHER	199
Irish Forestry, Report of Departmental Committee. Reviewed	183
" Woodlands. W. R. FISHER	91
" " A. MCRAE	27
Larch Blister. W. R. BROWN	88
" Russian. H. T. ELWES	221
Lime Tree Disease. T. GILBERT	87
Lists of Books, &c.	79, 135, 209, 316
Lockeley Hall Estate, Hants. F. ARTHUR	210
Lumber Industry in America, History of. T. E. DEFEBOUGH. Reviewed by H. T. ELWES	123
MANSON, F. B. Obituary Notice	283
Maraby Woods, Lincolnshire. W. B. HAVELOCK	313
Mathey's "Commercial Utilization of Wood." Reviewed by W. R. FISHER	288
Okshott Wood. Working-plan. W. R. FISHER. Reviewed by E. P. P.	290
Railway Rates. SIR HUGH BEEVOR	80
Sales of Timber	80, 143, 216, 315
Sequoia Wellingtonia. W. B. HAVELOCK	313
Sophora Japonica. J. WILSON	212
Stisted Hall Woods, Essex. Working-plan. By W. R. FISHER	224
Switzerland. Notes on Forests. T. MORRELL	245
Taxation of Woodlands. C. H. DONNE	4
" R. ANDERSON	14
Tortworth. A. HENRY	54
Tubney Arboretum. W. R. FISHER	70
Trees and their Life-Histories. P. GROOM. Reviewed by W. S.	125

Official Notices.

THE Publication Committee of the *Quarterly Journal of Forestry* is as follows :—

Arboriculture.—H. J. ELWES, F.R.S., Colesborne, Cheltenham; A. HENRY, M.A., F.L.S., Reader in Forestry, University of Cambridge.

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Forest Education.—J. SMITH HILL, B.A., Principal, Agricultural College, Aspatria, Cumberland.

Irish Forestry.—A. C. FORBES, F.H.A.S., Dept. of Agriculture, Dublin; A. E. MOERAN, Palmerston House, Portumna, Co. Galway.

Mycology.—M. C. POTTER, M.A., Professor of Botany, Armstrong College, Newcastle.

Advertisements and Exchange Column for Plants and Seeds.—E. DAVIDSON, Assistant Secretary, R.E.A.S., Haydon Bridge, Northumberland.

Foreign and Colonial Forestry and Chief Editor.—W. R. FISHER, M.A., 6, Linton Road, Oxford.

Any papers intended for publication in this Journal may be sent either to the Chief Editor, or to one of the Sub-Editors.

Official Notices.

HOME-TIMBER FOR TELEGRAPH-POSTS.

The Postmaster-General has revived the question of the possibility of using, if only to a very limited extent, native-grown timber for telegraph poles, and seeks information on the subject. The names and addresses of forest or plantation owners whose estates might be expected to yield suitable timber, in fir preferably, and in larch, should be sent to Mr. C. Morgan (Assistant-Controller). As the felling season has already commenced, he would regard it as a favour if such information were furnished at the earliest possible moment.

Stores Dept., G.P.O., 17-19, Bedford Street,
London, W.C.

IRISH DEPARTMENTAL COMMITTEE ON FORESTRY.

The Irish Departmental Committee on Forestry completed its sittings for taking evidence on the 13th of December. Strong evidence goes to show that timber-felling is being practised on a large scale, and that much of the timber is being shipped in the round to Great Britain, while the Irish sawmill owners are fearing a local timber famine in a few years. Owing to the present large sales of standing timber, prices obtainable by owners of woodlands are very low.

The Committee will meet again in Dublin about the 20th of January, to draft their preliminary report.

SALES OF "JOURNAL" TO FORESTRY STUDENTS.

The parts of Vol. II., *JOURNAL OF FORESTRY* will be sold at the rate of 4s. a year for the four parts to forestry students at recognised forest schools.

Application for the *JOURNAL* for such students should be at once sent in by the principals of recognised schools of forestry and agriculture, to E. Davidson, Haydon-Bridge-on-Tyne.

CONTENTS.

	PAGE
ORIGINAL ARTICLES:—	
Stokenchurch. G. Bull	1
Yield of Beechwoods. H. R. Beevor	1
Taxation of Woodland. C. H. Donne	4
" " R. Anderson	14
 Irish Notes :	
Excessive Fellings. A E. Moeran	24
Present Conditions of Irish Woods. A. McRae	27
 OFFICIAL PAPERS:—	
Summer Meeting of the Royal English Arboricultural Society :	
Earl Bathurst's Woods	32
Royal Agricultural College Forest Garden	37
Colesborne	39
High Meadow Woods	49
Tortworth	54
Ashton Court	59
Annual Report of Tubney Arboretum	70
 REVIEWS AND NOTICES OF BOOKS:—	
Schlich's working-plan of the Ardross Woods	75
 CURRENT TOPICS AND SHORT NOTES:—	
Honours to Members of the R.E.A.S.	79
Forestry Education	80
Railway-Rates	80

Contents.

	PAGE
Sales of Timber. J. P. Robertson	80
Ireland. A. E. Moeran	81
Eastern Counties. C. Hankins	83
Woburn and District. F. Mitchell	83
North-west Somerset. H. Reid	85
Bolton Abbey and District. J. Mitchell	86
Deeside, Aberdeenshire. J. P. Robertson	87
Disease in Lime Trees. J. Gilbert	87
Larch-blister, Stratfieldsaye, Hants. W. R. Brown	88
Woods at Thirlmere. W. R. Fisher	89





"TRY LIFE."

Quarterly Journal of Forestry.

No. 1.]

JANUARY, 1908.

[VOL. II.

STOKENCHURCH.

UNKNOWN to fame, lost in the height
Of Chiltern's breezy tableland,
A woodland village of delight
Where men still live by craft of hand.
In groves of beeches axes ring,
Tall timber falls, strong wagons bear;
The woodlanders at labour sing,
Such zest is in the forest air.
They cut and turn the fragrant wood
In hut and workshop, where the chips
Fly blithely to the sportive mood
Of singing wind and echoing lips.
Upright and bronzed he hails the day,
The worker blest with wage and health.
Who seeks Earth's treasure need not stray;
In this rare village life is wealth.

GERALD BULL.

THE YIELD OF BEECHWOODS.

BEECHWOOD has, at present, in Great Britain a very variable price, because the wood is of less general use than oak or ash, and the centres at which it is converted are accordingly often at such a distance as to involve a heavy cost of transport.

It is, however, reasonable to expect that with the imminent cessation of the imports of American hardwood, the price of this timber will rise, and then the plantations of beech may equal in value those of any other timber.

Two advantages attach to the cultivation of beech : First, it is less exacting than oak or ash in the quality of soil that it demands ; secondly, it puts on a considerably greater volume of timber—so much so, that one may count upon one-fourth as much again as oak.

Full evidence of this large yield appears in any work on Continental forestry, and we are not without instances in England. A good example was to be found on the South Downs recently, and the crop partly felled was shewn in the illustration at the commencement of No 2, Vol. I. of this

journal. It is a high forest of beech that has stood too long, and is losing value by decay below, but it affords a good sample of the possibility in England of producing such timber as we see on the Continent. Measurement of standing trees and recent fellings pointed to an approximate crop of 10,000 cubic feet an acre, but it had stood for 200 years, and should no doubt have been cut some 100 years ago. If this were the yield on a gravel over chalk, we can believe in the better yields under good conditions, such as Baur reports, 63 cubic feet in 120 years; and it is even stated by Brouillard, that at Seeland, in Denmark, beechwoods in ninety years yield 90 cubic feet per acre.

The yields of British beechwoods are usually reported from those grown on the selection system. A series of these were given by Mr. A. Vernon, to the Departmental Committee on British Forestry, 40 to 44 cubic feet being a common annual yield. Another series, reported at the Surveyors' Institute by Mr. A. Macdonald Brown, probably exceeds this, the terms being stated in money at £3 per acre annually.

To compare the results of yield one with another on the high forest system is easy, but on the selection system it is impossible without repeated valuations of the standing timber; because 2,000 cubic feet left on an acre will produce more than a stock of 1,000, and one may find instances of woods holding a stock, after felling, of any figure between those two. Then it will require a very nice calculation to say which wood, at the next fell, has paid best, especially as at the same time the prospect of its continuance of good yield must be taken into consideration.

The experienced forester, both abroad and at home, bids the grower beware of any law or system in the management of his wood beyond the broad instruction: "Act for the good of the forest," or, as the Frenchman puts it: "Comme un bon père de famille"; that is to say, let the trees be as numerous and of as good quality as possible, maintain the quality of the soil, and see that reproduction is constantly assured.

The traveller who walks over some twenty miles of Buckinghamshire country will find many examples of different management, and the results are not readily to be explained.

One, not uncommon, sight (*see* frontispiece) is to find the best natural regeneration where standing and recently felled trees have not been larger than 20 cubic feet, which runs counter to the accepted idea that an age of eighty years is to be looked upon for a fall of beechmast. This experience should emphasise the fact that thinning is the great factor in regeneration. The fellings annually occur with no regard to beechmast years, and are especially directed to spacing the crowns of foliage.

If it is difficult to compare the value of two woods growing under the selection system, still more does the calculation become involved should one endeavour to compare the money value of a selection system wood with that of a high forest of beech.

Such good woods as are grown from a standing timber crop of 2,000 cubic feet left after a felling, will be found, I calculate, to give the same money value in fifty to sixty years, as will be attained by the high forest clear-cut at 100 years, allowing that high forest gives a similar and good average annual yield of 60 cubic feet per acre per annum. Having regard to the initial capital, 2,000 cubic feet, of the selection system, there does not seem to be any choice in the value of the very best results of the two systems compared as above. We must admit, not only from an aesthetic point of view do we prefer the selection system, but we find in the frequency of intermittent yield an opportunity for the private owner to indulge in forestry, that might be denied him on the system where returns are so long deferred as from 80 to 100 years.

Thus one holds that the selection system may well be defended from a forestry point of view, as well as for soil-protection and other peculiar circumstances.

I have already said that wisely there cannot be any hard-and-fast rules of management, and I claim such to be the result of a careful enquiry and analysis by measurement of several acres. It has been said that the inexperienced person may proceed upon the system of finding the mean annual yield and cutting accordingly. Practically one finds that there are so many gradations and variations from acre to acre, as one surveys a wood, that "the mean annual yield" would after all have to be applied with such care as a measure, and so

differently, that one would be really falling back on the general principle of "doing the best for the wood."

I may quote the results I found in a heavily stocked wood, which had given a heavy yield the previous fell, but in which, nevertheless, the yield was rising.

Forty-one trees per acre of 31 cubic feet were taken, and 123 of 16 cubic feet left; the trees were seventy-five years old when felled, and the formula of removal of one quarter of the trees and two-fifths of the timber, as on this acre, seemed to stand good for all parts of the wood, which elsewhere was less dense. The individual trees were growing at a rate of 2 inches quarter-girth in twelve to thirteen years, giving at compound interest $3\frac{1}{2}$ per cent., and such seemed to be the rate of production throughout the wood. This stock of 2,000 cubic feet rising in twelve years to over 3,000 cubic feet at felling is heavier than is usual, but was possible on the deep loamy clay on which the trees were growing.

The rate of interest on the money value represented by the stock of timber left standing after a felling, would be higher than that of the timber growth, inasmuch as the smaller timber is less valuable than the larger timber which it so shortly becomes.

These very general considerations are all that I can offer, after having sought to solve the question by detailed measure of many a quarter acre of beechwood. I hope that the arguments, though based only on general grounds, may be both serviceable and correct.

H. R. BEEVOR.

TAXATION OF WOODLAND.

Awarded Gold Medal by the R.E.A.S.

INTRODUCTORY REMARKS.

BEFORE it is possible to consider the question of the taxation of woodlands in particular, it will be necessary to glance, as briefly as possible, at the relative proportions in which the two great classes of property, real and personal, contribute to taxation, (1) National,

(2) Local. From an abstract point of view the ideal incidence of taxation cannot be better expressed than by the following extract from the report on the subject by Sir Edward Hamilton and Sir George Murray, who were in agreement with the Majority Report of the recent Royal Commission on Local Taxation in saying: "We hold that the primary principles to be aimed at are (1), that persons should contribute, as far as is reasonably practicable, to onerous expenditure according to their ability to pay; and (2), that as far as is reasonably practicable, they should contribute to beneficial expenditure according to benefit received."

I think it will be allowed that these two classes (of (1) onerous, and (2) beneficial expenditure) ought to correspond as closely as possible with those given above, and that so-called national or onerous taxes, which should contribute to the welfare of the nation as a whole, ought consequently to be borne, so far as is reasonably practicable, by every citizen in accordance with his ability to bear them.

Is this the case at the present time?

Confining our considerations solely to the inhabitants of the British Isles our answer may be either Yes or No. It will be more or less in the affirmative if we hold that only those burdens which are at present paid for out of the National Exchequer can be rightly classified as national or onerous—I say more or less, because I venture to suggest that even the three great national services (Army, Naval and Civil) do not, under existing circumstances, contribute equally to the prosperity of owners of real and of personal property. We have become a great commercial and territorial Empire and have practically ruined the British landowner (as such) in the process—but we shall certainly have to answer this question in the negative if we hold, as I do, that such burdens as the relief of the destitute, the education of children whose parents cannot afford to provide an education for them, and the provision of county asylums—not to mention such questions as the maintenance of the police and of main roads—are distinctly and entirely national or onerous.

When these and other "local" burdens were first imposed they were themselves of comparative insignificance and the

bulk of the wealth of the country lay in the land. Now they are by no means insignificant, and the wealth of the country has migrated from the rural to the urban districts.

Commerce has taken the place of agriculture as the chief industry of the nation, and in consequence the expenses of local administration have been very greatly increased, so that a very unjust share of the burden now falls on the weaker partner.

In considering this question it must also be borne in mind that rates were imposed originally on both real and personal property, *i.e.*, they were intended as a local income-tax ; and personality was in fact theoretically liable to be rated until 1840. It has, however, always been found practically impossible to assess locally property of this kind, and its legal exemption in 1840 was followed two years later by the re-establishment of the income-tax more or less in its present form.

TAXES AFFECTING WOODLANDS.

So much for the case of the owner of real property, in general. Let us now go in more detail into the case of the owner of woodlands, in particular.

For this purpose it is necessary to divide taxes into three classes :—

- (1) Land and income taxes, and tithe.
- (2) Death duties.
- (3) Local taxation or “rates.”

LAND TAX.

Land-tax is the oldest of all existing taxes and its history is somewhat interesting. It was first imposed in 1692, as a general tax (at 4s. in the £) on all property *real and personal* (why is it called land-tax ?) and on all profits, salaries, etc. In 1797, the amount to be raised was fixed at £1,989,673.

This amount was to be raised by a fixed quota from each parish. The valuation of the parishes that was adopted was that of 1692, and these quotas have never been altered ! Hence the proportionate rate of this tax varies inversely with the amount by which the rateable value of a parish has increased since

1692. If to this we add the fact that the full burden of the tax now falls on the land alone, it will be obvious at once that such a tax must fall very heavily on the owners of present or prospective woodlands; for the rate in the pound is highest where the increase in population has been least, and consequently where the value of the land is lowest, but it is only in such districts that woodlands on at all an extensive scale can be expected to pay.

Some relief was afforded by the Finance Act of 1896, which fixed the maximum rate in the pound at 1s. and reduced the terms of redemption to thirty years' purchase, and also by that of 1898, which allowed certain exemptions and abatements in the case of small incomes.

It must be remembered in addition that unless the rate is either the maximum (1s.) or the minimum (1d.) there is no fixed basis for assessment.

INCOME TAX AND TITHE.

Income-tax, imposed originally in 1799, proved so unpopular that it was repealed in 1815, but was re-imposed in 1842, and it is the Income-Tax Act of that year and that of 1853 which govern this tax. To these we must add, so far as the assessment of woodlands is concerned, the Rating Act of 1874, which will be referred to more fully later on.

Woodlands are usually occupied by the owner and the assessment must therefore be the same as that for the Poor-Rate.

Income-tax is, speaking correctly, payable only on income and it ought, therefore, to be possible to obtain a refund in any year in which no income is received from a plantation or wood. Such a contention is, however, put out of court, and I think justly so, owing to the fact that as woods are assessed under Schedule A, and not under Schedule D, the accruing value must be taken into account and not only the net-profits. The occupier, who is, of course, usually the owner, has also to pay under Schedule B; there is no escape from this on account of absence of profit, as in the case of an occupier of agricultural land.

Tithe may fall very heavily on existing or future woodlands. Where this burden exists, the apportionment is fixed, and there

is no possibility of appeal on account of reduction in value of the land, unless the amount payable in any year would exceed two-thirds of the annual value of the land as assessed to Schedule B. In such a case a rebate of the amount of this excess can be claimed under the Tithe Act, 1891.

DEATH-DUTIES.

Of Death Duties there are two to which real property is liable—(1) Estate Duty, and (2) Succession Duty.

Estate Duty was substituted for the old probate and account duties by the Finance Act, 1894.

A percentage, varying according to the gross value of the estate, is payable on the capital value of all property passing on a death.

According to this Act, where no part of the capital value is due to expectation of increased value, the capital value of agricultural land (which term in this case includes woodlands) is not to exceed twenty-five years' purchase of the annual value as determined by the property-tax assessment, less any additional deductions allowed by the Succession Duty Act, 1853, and up to 5 per cent. for management.

Now, by the Income-Tax Act of 1842, and the Rating Act of 1874, standing timber as such is not liable to taxation, and consequently no separate assessment of it is made. But if the estate in question happens to be a poor one, worth less than twenty-five years' purchase of the property tax assessment, the value of the timber must be added to the capital value, provided only that the capital value of the estate and timber together do not exceed the twenty-five years' purchase. Hence it follows that the timber pays duty if it happens to be situated in a poor district, but not if it is in a rich one. This "dole" to the landowner may also operate in another way to the disadvantage of a man succeeding to woodland. Thus, his predecessor may, for some years before his death, cut heavily, and diminish the capital value of the woodlands, while increasing their annual value for income-tax purposes. In this case the successor has to pay additional income-tax on a deteriorated succession.

In addition to the ordinary estate duty, an extra duty of one per cent., called settlement estate duty, is levied on settled estates, unless the only life-interest after that of the deceased is that of a wife or husband.

Both estate duty and settlement estate duty are payable only once during the continuance of the settlement.

Succession Duty was imposed by the Succession Duty Act of 1853, and is regulated by that Act as amended by the Finance Act, 1894.

It is a charge levied on a succession to property, unless (1) the successor is husband or wife of the predecessor, or (2) the total value of the predecessor's estate does not exceed £1,000, and estate duty has been paid on such property.

The method of payment in this case depends on whether the successor is competent to dispose of the property or not.

(a) Where the successor is competent to dispose, a tax is levied on the capital value as ascertained for estate duty, less that duty. The payment of this may be spread over eight years.

(b) When the successor is not competent to dispose, his interest, with certain exceptions, is to be considered to be the value of an annuity equal to the annual value of the property, less certain deductions.

The exceptions include timber and woods, but not underwood or coppice. In the case of timber and woods the successor is to pay on net-profits of over £10 per annum, as they are received. But if the timber is subsequently sold standing with the property, as a whole, the payment of this duty is avoided. The owner may compound for this duty.

With these exceptions the operation of succession duty is practically the same as that of estate duty.

It is well known that the death-duties are apt to affect the woodlands of an estate very injuriously.

In the first place, they are liable to be very unjust in their incidence, as above explained; and in the second place, the woodlands are far too frequently looked to for the payment of a large proportion of the duties, although, of course, the responsibility for this cannot be laid to the charge of the duties as such.

RATES.

I venture to think that no one who takes any interest in matters agricultural, and has studied the incidence of local taxation, will have disagreed with me when I endeavoured to prove at the beginning of this essay that incidence is very unjust to the owner of real property.

The fact indeed has been recognised by the passing of the Agricultural Rates Act, 1896, and by its subsequent continuance.

The express exclusion of woodlands from the operation of that Act is very significant, for it proves that they are looked upon merely as a pleasant amenity to an estate, and in no sense as a possible commercial asset. This fact has been further emphasised by the one-sided nature of the game clause in the Agricultural Holdings Act, 1907. Any owner, therefore, who wishes to look upon his woods as a profitable source of income, apart from their value as rabbit-warrens, has, I think, a very just grievance.

Prior to 1874, only saleable underwoods were rateable, but since the notorious Act of that year, all woodlands not subject to any rights-of-common, are liable to be rated in accordance with the following rules:—

(1) Land used for the growth of saleable underwood is to be assessed at its annual value for that purpose.

(2) Land used for the growth of timber is to be assessed at the rent it would fetch if let *and occupied* in its natural and unimproved state.

(3) Land used conjointly for both these purposes is to be assessed according to one or other of the above rules, as the Assessment Committee may elect.

The assessment arrived at in accordance with these rules is of great importance, as it regulates the assessment for income tax, and consequently that for death-duties, and usually also that for land-tax.

The correct assessment of land bearing saleable underwood is obtainable with a certain amount of accuracy.

For the "prairie value" of land under timber various figures have been adopted, the average of which is about 8s. per acre. As the basis is entirely problematical it is impossible for anyone

to say whether any figure is too high or too low, provided only that it does not exceed the rental value of the adjoining agricultural land, for it has been decided (*Earl of Westmoreland v. Southwick and Oundle*, 1877)—that the assessment may not be based on the hypothetical rent obtainable after expenditure has been incurred in grubbing up woodlands and fitting them for agricultural purposes. The assessment may, however, be increased by the value of the woodlands for sporting purposes (*Eyton v. Churchwardens and Overseers of Mold*). The amount payable under this additional assessment should, of course, be charged to the game account, and not debited to the woods. For expenses incurred under the Public Health Act, 1875, and adoptive Acts; woodlands are assessed at one-fourth only of their annual value. As, for the purpose of Acts such as the Lighting Act and the Public Libraries Act, "land," in rating parlance, includes even gas-pipes and telegraph-posts, it is to be presumed that woodlands would be covered by the term, and would therefore receive differential treatment. But as regards the Lighting Act the decision in the case of *Thursby and another v. Churchwardens and Overseers of Briercliffe-with-Entwistle* appears to introduce an element of doubt.

Any objection to the incidence of rates on woodlands must be enhanced by the fact that the services paid for benefit such property to a very small extent only. Also, when the woods do begin to derive some benefit, e.g., by the use of the roads, they are liable to be mulcted in damages for extraordinary traffic.

THE RELATIVE INCIDENCE OF TAXATION ON DIFFERENT KINDS OF WOODLAND.

HIGH WOODS.

It will be obvious that this incidence will be heavier in the case of young plantations than of established woodlands ; for in the case of the former, any outgoing, however small, per acre and per annum, will amount to a very considerable sum when calculated at compound interest, even up to the time when the plantation first begins to pay its way, and will therefore reduce the prospect of profit throughout the rotation. According to

the Parochial Assessment Act, 1836, the rateable value of any hereditament is to be "the rent at which the same might reasonably be expected to let from year to year. . . ." Who would give any rent for a five-year-old plantation provided that he had to manage it properly? Some Assessment Committees will remit the rates for the first year or two of a newly formed plantation, but as a matter of fact I cannot see that they have any legal right to do so.

Established woodlands, on the other hand, ought to be bringing in an income in excess of the assessment, and may in fact be looked upon as reaping the benefit of the burdens borne during their younger stages.

I think that we have here the key to the correct incidence of taxation of woodlands *inter se*, viz., that throughout their existence they should be assessed on the basis of actual or reasonably possible profit.

By this method only can the man who reaps the benefit be made to bear the burden.

The adoption of such a method might quite possibly result in increased assessments of all woodlands reaching maturity, and it would in fact cause these woods to pay an undue proportion of rates for one rotation. But what progress can ever be made without inflicting some hardship in its inception? And in this case I must confess that I consider the benefit to be derived is sufficiently great to justify a certain measure of hardship, for the adoption of some such method would undoubtedly tend to encourage both the formation of new plantations and the more efficient management of existing ones.

SELECTION WOODS, ETC.

Woodlands such as the Chiltern Hills beechwoods, managed under the selection system of natural regeneration, should be practically unaffected by such a change. The relative proportion of taxation borne by them may, for purposes of present consideration, be taken as fairly just, for their rental value can be arrived at fairly easily and definitely. Their case approximates in fact more closely to that of **Coppices**, which are already, in accordance with the Rating Act, 1874, rated on their rental value.

This should of course, at the present time, be very low in most cases.

The case of **coppice-with-standards** is distinctly anomalous, for it may be assessed on the same basis as pure coppice, in which case its rateable value should of course be lower than the latter, while its value would at the present time, with very few exceptions, be distinctly higher. If a storm is raised, the assessment committee have, however, the safe harbour of "Prairie Value."

CONCLUSION.

If the taxation of woodlands is considered in any respects unfair, every effort should be made to redress the injustice; for the burden, in the case of young plantations especially, will amount to a very considerable sum in the course of years; and there is no doubt that this fact frequently acts as the last straw in deterring an owner from the formation of new plantations. In fact it is allowed that the Rating Act of 1874 has exerted a very deterrent influence in this respect. It is perhaps impossible to expect a nation of shopkeepers, living only for the present, to assist the forester to their own temporary disadvantage, but his just demand for a fairer distribution of the burdens of taxation cannot be too often insisted upon, especially in view of the possibility of fresh legislation upon the subject. As I have suggested above, tithe and land-tax, unjust as is usually the present incidence of both, are extremely difficult to tackle. The death-duties are a very heavy burden upon woodlands in the poorer districts, but in this case sleeping dogs are perhaps best left alone, as any change would very possibly result in a separate duty on timber in all cases.

We have now to deal with income-tax and rates.

Income-tax is a national burden, and as such should be borne by every citizen in accordance with his ability; of the burdens we have considered it is undoubtedly the most just in its incidence. But if the suggestions I made in my prefatory remarks, as to the proportionate benefit derived from this and kindred taxes, are worthy of any consideration, they might be brought forward in support of the forester's claim for more just treatment so far as local taxation is considered.

It is undoubtedly in the case of rates that the owner of woodlands should demand relief.

If such national services as poor relief in all its forms, and the maintenance of the police and of main roads were transferred from the ratepayer to the broader back of the taxpayer it would be of great assistance to forestry, for it must be remembered that woodlands pay full rates for all these purposes. But the incidence of local taxation, e.g., for the maintenance of local roads, will never be fair as between neighbouring rural ratepayers until the woods are assessed on a profit system of some kind.

MOOR PARK ESTATE OFFICE,
RICKMANSWORTH.

CYRIL H. DONNE.

TAXATION OF WOODLAND.

Awarded Silver Medal by the R.E.A.S.

THIS subject, though uninteresting and complicated, requires the careful attention of intending planters, since in addition to the initial outlay incurred in afforestation all future annual charges must be taken into account. However skilful the forester may be in keeping the expense of planting and subsequent management within proper limits, he has no control over the annual demands for local rates and imperial taxes that have so largely increased in late years, and which, under existing conditions, must continue to increase.

There being always four, and sometimes five, different valuations or assessments on which these are based, it is difficult to present the subject with reasonable brevity and clearness, in particular as woodlands are subject to varied changes according to their situation in rural or urban districts. All woodlands are, however, liable to :—

1. Poor-rate	{	levied for what is called local expenditure.
2. County rate		
3. Income-tax		
4. Land-tax		

For each of these there is a different assessment, or basis of valuation.

Other woodlands may be chargeable in respect of the borough, or urban district rate, lighting and watching, baths, and washhouses, public improvements, public libraries and the provision and maintenance of burial grounds.

All these are annual charges, but the Finance Act, 1894, imposed a new burden in the shape of the death-duties, which, though not payable yearly, fall at uncertain intervals and very heavily upon the successors to landed property.

In addition to these, the rentcharge in lieu of tithes, as commuted and apportioned by the Act of 1836, must be taken into account, since it is charged upon a large proportion of the land of England and Wales.

In an endeavour to reduce this tangle to something like order, the rates and taxes that have been enumerated will be dealt with in sequence, and a brief account given of each, together with the method of assessment.

POOR-RATE.

Money collected for poor-rate is applied not only to the relief of the poor, but to a proportion of the cost of pauper lunatics and salaries of medical officers of health, inspectors of nuisances, etc., repair of rural roads, and the administration of the Public Health Acts. With it is also collected the county rate, as will be hereafter explained. In order to obtain the necessary means for poor-relief the guardians of the poor address precepts to the overseers of each parish within the union for contributions to the common fund. The other spending authorities do the same in respect of their requirements. The overseers then proceed to make a valuation of the parish in accordance with the Act of the 43rd of Elizabeth, 1601, which enacts that they shall "raise by taxation of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, tithes impropriate, proprietors of tithes, coal-mines or saleable underwoods, in the same parish, in such competent sum and sums of money as they shall think fit, a convenient stock of flax, hemp, wool, thread, iron and other

ware and stuff; to set the poor on work, and also competent sums of money for and towards the necessary relief of the lame, impotent, old, blind, and such other among them being poor and not able to work, and also for the putting out of such children to be apprentices to be gathered out of the same parish according to the ability of the said parish."

It may be noted that under this Act personal property was held to be rateable, but since 1840, it has been annually excepted by Act of Parliament. The parish valuation list sets out the owners and occupiers of rateable property, the description and acreage, with the gross estimated rental and rateable value of each, the required amount being levied by an equal pound rate on the latter. "Gross estimated rental" is the rent at which the hereditaments might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes and tithe rent-charge, and "rateable value" is arrived at by deducting from the gross estimated rental the probable average annual cost of the repairs, insurance, and other expenses necessary to maintain the premises in a state to command such rent.

Among properties specifically charged under the Act of 1601 saleable underwoods are included, but, there being no mention of other descriptions of woodland, such were not in all cases considered rateable, and in order to bring these (as well as mines other than coal-mines, and sporting rights) into assessment, and to secure uniformity of practice, the Rating Act of 1874 was passed, which, among other things, extended the Poor-rate Acts to "land used for a plantation or a wood or for the growth of saleable underwood, and not subject to any right-of-common."

The valuation having been made by the overseers of each parish and adopted by the Assessment Committee of the union, becomes the basis. Aggrieved ratepayers may, however, appeal to the committee, and if they cannot obtain the relief to which they think they are entitled, have a right of further appeal to Quarter Sessions.

SANITARY RATE.

As previously stated, this is included in the amount collected as poor-rate, precepts being addressed by the sanitary

authority to the overseers, who raise the amount from each contributory place. This rate defrays the expenses incurred in carrying out the provisions of the Public Health Acts.

EXPENSES OF PARISH COUNCIL.

These are now also included in the poor-rate collection, the council issuing precepts for the required amount on the overseers, in the same way as the guardians and the sanitary authority.

COUNTY RATE.

Although there is a different assessment for the purpose of the county rate, it is collected through the overseers, the county authority directing them what to collect from each parish. The proceeds are applied to the cost of elementary education, to expenditure on main roads and bridges, grants to local authorities in respect of main roads in urban districts, salaries of poor-law officers, and maintenance of pauper lunatics and asylums, cost of police and prosecutions, registration of voters, repayment of loans, and salaries innumerable. Each ratepayer has to pay a share of his parish contribution in direct proportion to the amount of his assessment to the poor-rate. As between the parishes, the amount of their respective contributions are ascertained according to a "basis or standard" of the "full and fair annual value" of the property rateable to the poor in each parish. The basis does not, however, necessarily follow the poor-rate valuation actually in force. It is made by a committee of the county council, and the overseers of each parish have the opportunity of objecting and appealing.

THE VALUATION OF WOODLAND FOR RATING PURPOSES.

By the Rating Act of 1874, woodland is divided into three classes, directions being given as to the method by which each class is to be valued as follows :—

A. *Land used only for a Plantation or a Wood.*—The value is to be estimated as if the land, instead of being a plantation or a wood, were let and occupied in its natural and unimproved state.

B. *Land used for the Growth of Saleable Underwood.*—The value to be estimated as if it were let for that purpose.

C. *Land used both for a Plantation or a Wood, and for the Growth of Saleable Underwood,* when the value is to be estimated either as if it were used only for a plantation or a wood, or for the growth of saleable underwood growing thereon, as the Assessment Committee may determine.

In the first case A, in arriving at the rent, the land is to be considered as if divested of timber or wood, and account must not be taken of any improvements that have been made, or of which the land may be capable. In other words, it is to be valued as wasteland in its natural state. This will vary from say 6*d.* an acre in bare and mountainous districts, to possibly as much as 10*s.* an acre in the case of the most naturally productive land that can be imagined. Perhaps 3*s.* to 4*s.* an acre may be taken as an average gross estimated rental, from which an allowance of 5 per cent. is usually made to arrive at the rateable value.

If the woodland comes under definition B, and is not actually let, a calculation must be made of the rent a tenant would pay, and at the present low value of coppice, the rental value is nominal.

Take, for example, a coppice cut in regular course at twelve years' growth, one-twelfth every year, the value of the crop when cut for sale being £12 an acre.

	s. d.	£ s. d.
Per acre per annum, £12 ÷ twelve	1 0 0	
Less cost of felling, repairs to roads and fences, sale expenses, etc., say	4 6	
Occupier's share, say 10 per cent. on capital of £6 an acre	12 0	
Tithe rent-charge and rates, say	0 6	
	<hr/>	<hr/>
Gross estimated rental per acre	3 0	
Less for planting up blanks, etc., say	1 0	
	<hr/>	<hr/>
Net rateable value per acre, exclusive of sporting rights	2 0	
	<hr/>	<hr/>

Since land carrying coppice-with-standards, which is the more usual description of wood in* the English counties, coming under definition C, will not grow underwood equal in value per acre to pure coppice, the Assessment Committee will naturally elect to deal with it as if in its "natural and unimproved state" as before.

Where sporting rights are not severed from the occupation, or, in other words, when they are enjoyed by the occupier of the woodland, a separate rate in respect of such rights is illegal, and their value must be added to the above. If the woodlands are properly managed as such, and not merely employed as a medium for sport, there will be no ground game, and the value is that of a means of providing facilities for the expensive luxury of rearing and shooting pheasants. In this case an addition of 1s. an acre is sufficient.

INCOME-TAX.

Schedule A.—The Income-tax Act, 1853, provides that this tax is to be levied "in respect of the property in all lands, tenements, hereditaments, and heritages in the United Kingdom." The basis is the rent by the year at which the lands are let at rack-rent, subject to a deduction of one-eighth under the Finance Act, 1894. There is a quinquennial assessment. The General Commissioners appoint assessors and issue precepts. The assessors serve notices on owners and occupiers to supply information as to rents, etc., and these returns are laid before the surveyor, who submits them to the Commissioners. When the assessment has been allowed, aggrieved parties may appeal to the Commissioners for redress.

Schedule B.—This is popularly supposed to be a tax on "farmers' profits," but it actually falls upon all "occupiers of lands," etc., in the United Kingdom, and by the Finance Act, 1894, is charged on one third of their annual value, or in practice one third of the tax charged upon the same hereditaments for Schedule A. is demanded in respect of Schedule B. Income-tax is also payable under Schedule E. upon receipts from hedgerow timber, but this is beyond the scope of this paper.

LAND-TAX.

This differs from every other tax in that the aggregate amount due from each parish is fixed in perpetuity. This amount, called a quota, was fixed in 1798, when the Act was passed, and raised by an equal pound rate on all property, including stock-in-trade, in the kingdom. Since the amount to be raised in each parish remains the same, while the value of the respective properties has materially altered, the amount in the pound varies considerably. It may not now exceed one shilling, or be less than one penny in the pound.

The assessment is made by assessors, and should be on the net annual or rateable value, although it is more often calculated on the gross estimated rental. Land-tax being redeemable, the original quota is reduced by the amount of the tax formerly charged upon the property that has been exonerated, which is taken out of the assessment. The only appeal is to the Local Commissioners, whose decision is final. Personal property has ceased to be assessed to land-tax.

BOROUGH, OR URBAN, DISTRICT RATE.

This is levied on property situated within a borough or urban district, generally, but not necessarily, upon the same basis as the poor-rate, and the money raised is expended on the maintenance of streets, sewerage, public lighting, interest and repayment of loans, salaries of officials, etc. Woodlands are assessed at one-fourth of their value.

LIGHTING AND WATCHING, ETC.

Rates made for these purposes, and for baths and washhouses, public improvements, public libraries, burial grounds, etc., are levied under the authority of "adoptive acts," and are so unfrequently chargeable on woodlands that it is not necessary to refer to them beyond saying that there is always the possibility that land in the neighbourhood of a town may be brought within their scope. *Sewers' rates* are charges in respect of the drainage of low-lying lands and their protection from floods, and woodlands do not occur to any considerable extent in such situations.

Having briefly dealt with the nature of the rates and taxes on woodlands, with the objects to which they are applied, and the methods of assessment, an attempt will be made to estimate the total to which they may amount in the pound.

		<i>s. d. s. d.</i>
<i>Poor-rate.</i> —Relief of poor, etc.	.. .	1 7
Highways and Sanitary	.. .	1 6
		<hr/> 3 1
<i>County-rate.</i> —Main roads, education, etc., etc.	.. . .	1 8
<i>Income-tax.</i> —Schedule A.	.. . .	1 0
,, B.	.. . .	4
		<hr/> 1 4
<i>Land-tax.</i> —Estimated average	.. .	9
<i>Death-duties.</i> —Reduced to yearly average	.. . .	1 9
		<hr/> 8 7

In the case of woodlands within an urban district, and I am acquainted with an instance where close on 1,000 acres in one parish are so situated, an addition of one shilling in the pound should be made to the above.

The estimated annual average of the death-duties and land tax in the above statement is extracted from a paper on "The Burdens on Real Property and Land," by an acknowledged authority, the late Mr. William Sturge, of Bristol, in the "Transactions of the Surveyors' Institution," Vol. xxvii, 1894. In the same paper Mr. Sturge estimates the average tithe rent charge at 3s. 6d. in the pound, and this, though neither a rate nor a tax, is a legal charge, the payment of which cannot be avoided.

Income-tax, as above, applies at present to the whole of England and Wales.

The figures quoted for poor-rate and county rate are those levied in a rural union in the county of Gloucester.

It must, however, not be assumed that 4s. 9d. in the pound

is levied for local taxation in every county. Since the amount to be raised in the pound depends not only upon the services to be paid for, but also upon the amount of rateable property in the county, it follows that where the latter includes mines, iron or other works, and manufacturing centres, the rate in the pound will be less than in counties where agriculture predominates and the valuation is low. This anomaly presses very hardly upon those counties that are chiefly rural, and consequently poorer in rateable value of property.

Comparison is sometimes made between British and continental methods of forestry, and a comparison may be made of their taxation. In the accounts of the Pfalzgrafenweiler Revier, in the Black Forest, for the three years 1899-1901, the average annual receipts from 2,760 hectares (6,900 acres) exceeded the expenditure by £17,156, a clear return of 5s. an acre. The taxes actually paid averaged £1,130, or less than 1s. 4d. in the pound on the net-receipts, a very different thing from being charged upon an estimated rent to be paid by a hypothetical tenant.

The burden and incidence of taxation and the defects in the system of valuation have continually occupied Parliament since 1850, when Sir G. Cornwall Lewis and Sir George Grey brought in a Bill to establish a "uniform mode of rating," until 1901, when the latest Royal Commission presented their report. Owing to the enormous increase in rates in recent years, due chiefly to the cost of elementary education and the improved standard adopted in the maintenance of highways, the question has become acute. Grants in aid are, it is true, made to local authorities from the Exchequer, but these, under existing circumstances, are wholly inadequate.

According to the report of the Local Government Board, 1905-6, these Exchequer grants amounted to only 23 per cent. of the total expenditure, the remaining 77 per cent. falling entirely upon rateable property. In 1896 Sir Alfred (now Lord) Milner, then Chairman of the Board of Inland Revenue, in his evidence before the Royal Commission, estimated the annual value of rateable property at £210,560,000, and that of non-rateable property at £228,839,000. If we assume that

the proportions are, roughly speaking, the same to-day, it will be seen that rateable property, including woodland, being less than half the wealth of the country, reckoning by annual value, pays more than three-quarters of the local taxation.

Woodlands have a special grievance in this question, since they remain chargeable, as in 1896, to full rates, whereas, by the Agricultural Rates Act of that year, agricultural land, excluding buildings, has been relieved of one-half the amount of rates raised thereon at that date for purposes of local taxation.

The Royal Commission reported in 1901 in favour of a distinction being made between those services which are *national* in character, and generally onerous to the ratepayers, and those that are preponderantly *local* in character, and confer upon ratepayers a direct and peculiar benefit more or less commensurate with the burden, the intention being that such national services should be paid for by the *nation* as a whole, and not chiefly by the owners and occupiers of one class of property. The Commissioners enumerated several services they considered to be national, such as poor-relief, including the maintenance of pauper lunatics, the provision of asylums, registration of voters, valuation, police and criminal prosecutions, etc., and also regarded education as "national to a high degree, as conferring benefit on the classes which participate in it, but doing little to increase the value of rateable property in a particular locality." The maintenance of main roads, they also considered, "on the whole to some extent to be a national service, and likely to become more so owing to the increasing mobility of the population and the development of new means of locomotion." (Motors.)

Since the date of this report the cost of elementary education has largely increased the ratepayers' burden, though not a penny raised for this purpose has been spent on education in forestry. Although owners of woodland are not numerically very strong, the Royal English Arboricultural Society, with its largely increased number of influential members, might do well to join forces with other associations having the same objects in view, and press upon Parliament the importance of

legislation to carry out the recommendations of the Royal Commission, and remove serious and admitted grievances that at present bear heavily upon all owners and occupiers, not only of woodland, but of every description of rateable property.

ROBERT ANDERSON.

THE BARTON, CIRENCESTER.

Irish Notes.

EXCESSIVE CUTTING OF TIMBER.

IT is very difficult to get for the purpose of comparison any reliable figures as to the amount of timber that is cut in Ireland year by year.

Such statistics as are gathered under the direction of the Department of Agriculture, though in other matters, I believe, accurate, are, as regards timber, quite palpably unreliable. The *vox populi* is not always a safe guide, but in this instance there can be no doubt that the general outcry that Ireland is being denuded of what timber she possessed, is really true. Not only have the local timber-merchants and the regular buyers from England more on their hands than usual, but a number of additional merchants have started business, some of them being men of considerable means, with several movable sawmills in different districts, and all seem to be getting as much timber as they can handle. The complaints made by timber-merchants as to the increased difficulty in getting trucks on the different railway lines, and the congested appearance of the loading bank at almost every station, point to the same conclusion. When we remember that for twenty years past any planting, except of ornamental trees, has been, literally, the rare exception among all but the largest proprietors, we are bound to arrive at the conclusion that the exhaustion of supplies must soon put an end to a

large portion of this trade ; and a knowledge of the actual condition of our woods should put a date to this stoppage at but a very few years hence.

The Land Purchase Act of 1903 is responsible for a great deal of this denudation, and it is really the Act that is to be blamed, and not either the landowner or the purchasing tenant, on whom usually the odium is indiscriminately laid. The landowner who proposes to sell his property, as every land-owner in Ireland must do sooner or later, and who has on this property outlying groves and plantations and hedgerow trees, or, what is very common, small, nicely wooded residences, once occupied by gentry, but now let to a tenant-farmer, is met by this difficulty—the Government will advance the purchasing tenant no money wherewith to buy the trees standing on the land. For they say, “It is impossible for us to watch these trees so that they shall not be cut, and our security thus vanish.” This practically means that the landowner either must make what he can by selling the trees to a timber merchant before disposing of his property, or else give them to the tenants, in which case experience has unfortunately shown that they are seldom spared for twelve months.

Of course, some of this timber is wide-spreading hedgerow elm and ash, very picturesque and desirable from the point of view of the general public, but undoubtedly an expensive luxury to the man who tills the land around them, except in such cases where shelter is of exceptional importance. It is unfair to abuse the purchasing tenant, who has never owned a tree in his life, and whose only knowledge of trees is an hereditary grudge against them in that, though exclusively the property of the landlord, they grow fat on his land, if in the first flush of ownership he indulges in the delights of a bargain with a local timber-merchant, and makes a clean sweep, not only of the hedgerow trees, but of immature or ornamental plantations and of shelter-belts and clumps of trees, of which, too late, he realises the use, and then sincerely regrets.

Some ultra-purists contend that these trees, not being in economically situated blocks, have nothing to do with forestry proper, but this is, I think, a very narrow-minded view and a fallacy besides. Both the extensive block of commercial

timber and the small shelter-belt are planted with an object in view, and the aim of forestry ought to be to accomplish that object as well as may be. The extent of the usefulness of either is merely a question of degree, and of this true forestry takes no account. The United States Forest Service is a model that we might very well copy. It has enormous areas under its control and very big problems indeed to solve, but it in no way ignores the most humble settler who is anxious to plant on his lot a few maples, Catalpas or Eucalypti for shelter, fencing material, or fuel. On the contrary, such a man is supplied, free of all charge, with the fullest particulars of the very best tree to plant, and the best way to plant it so as to secure his object; the Forest Service has spent its time and its money freely in experiments and research in order to qualify itself for giving encouragement by really reliable advice to the most unpretentious seeker after forestry knowledge. Not only so, but it goes further and freely states that, having now educated its Staff up to a point at which they can give really useful information to the public, its new duty is to educate the public to make use of this Staff. It is this keen business spirit, this, as it were "soliciting of orders" brought into a great government service, that has so largely helped it to overcome and disarm the prejudice and self-interest with which it had to contend, and has forced it upwards into the position of a popular and successful institution that it now enjoys. Those in Ireland who are interested in forestry, and their number is increasing in the most marked way, sincerely hope that the result of the recently appointed Committee of Enquiry into Forestry in Ireland will be, that the State, tardy beyond measure in matters silvicultural, will at last take steps to preserve "rural" timber that is economically profitable, and begin afforestation, which all authorities agree in advocating.

A. E. MOERAN.

PRESENT CONDITION OF IRISH WOODLANDS.

A GOOD deal has been said and written, during the last few years, on the present condition and future prospects of forestry in Ireland.

The picture of denuded and neglected woodlands cannot, we think, be overdrawn. But the bulk of these woodland areas belong to comparatively wealthy people. Is it fair, then, that the landowners of Ireland should rest on their oars, and wait for the Government to come and do their work for them? If we could be persuaded to make a steady and systematic effort to place our existing woodlands on an economic basis, and show conclusively that we can make forestry pay, then we should be justified in appealing to the Government for the practical assistance which will be necessary for the establishment of a proper policy of silviculture throughout Ireland. At present we have the sympathy of each of the successive Governments, and it is a question whether we deserve very much more. But let us try seriously to accomplish something, keeping in mind that "God still helps those who help themselves."

At present we think our hope lies in the intelligent advancement of "estate forestry," and especially in the systematic renovation of our existing wooded areas. These areas as a rule are worth comparatively little as they stand. But with judicious management and a little outlay even the very worst of them can be rendered remunerative.

On most estates in Ireland the woods may be divided into two sections, viz.—I. Ornamental woods and game-covers, etc. This section ought to produce a fairly steady income, but its extent and management must be regulated according to the taste and dictates of the owner, and the boundary lines should be very clearly defined, so as to prevent friction.

Section II., or "forestry proper," should embrace all woods which can be placed on a purely industrial footing; and it should be distinctly understood that they must be worked from an economic point of view, the owner especially emphasising the fact that he has no intention of losing money on the operations.

We will devote our attention wholly to Section No. II.

28 Present Condition of Irish Woodlands.

The first serious step is to eliminate rabbits and sentiment at one and the same time. This combination of evils renders "estate forestry" almost an impossibility as a paying concern. No forester should be expected to buy and erect miles of wire netting, and still show substantial credit balances at the end of the financial year. Rabbits can, and ought to, be killed down remorselessly where timber for profit is the ultimate end in view.

The mode of procedure will vary in different localities, but the main point to be remembered is that the woods themselves must produce a steady revenue, at least equal to the combined expenses of renovation and re-stocking. Of course, a good margin of cash profit would also be very desirable, and in many cases is certain.

But when we look at some of our gaunt skeletons, known as present-day woodlands, we maintain that the owner who can exchange them for well-stocked, healthy, flourishing plantations has no need to grumble; even in twenty years of gradual evolution, his assets will have become much more valuable, and his prospects much brighter.

The scheme should be outlined at the start, and a correct record kept of all the operations, including details of income and expenditure.

There may be isolated cases where the methods of selection or under-planting, or perhaps natural regeneration, may be tried, and where these systems are possible and likely to give good results advantage should be taken of them. But taken as a whole, our typical Irish woods permit of no half measures; they must, one by one, be cleared and replanted. The disposal of the timber presents a difficulty, and no single system can be recommended to meet all cases.

On some estates where the timber is good and the facilities for transit are reasonable, the timber-merchant may be the best medium for turning the timber into money. In other cases the estate sawmill will give the best results, while on some estates it may be necessary to try both plans. This will depend on the requirements of the locality, and must be settled on the spot. But generally speaking, the sawmill is the best method of coping with our mixed and usually inferior timber supplies.

Every effort should be made to cater to the local demand, and, if fair terms are given, there is not much difficulty in working up a fairly steady business; but the extent of the annual clearings must be regulated by the demand, care being taken to prevent a glut in the local market.

Replanting may cost anything from £5 to £10 per acre, according to the size and quality of plants used, expenses of draining, etc., etc., but even at this latter figure it is not so prohibitive as we are often led to suppose; and especially when we note the increased value of property, and the transference from chaos and the spirit of despair to methodical order and decided prospects of a sure income.

One point which strikes us very forcibly in connection with Irish forestry is the absolute necessity of providing means for the supply of better and cheaper plants. In Ireland we have cheap land and cheap labour—the chief factors which regulate the cost of production. Why then should we have to send to the great nurseries of England and Scotland for our forest plants?*

The rearing of forest trees is most essentially a rural industry; but every proprietor may not find it convenient to establish a private nursery, and as a rule it is not a satisfactory plan to run the nursery with the ordinary estate staff, as during times of special pressure the nursery work is apt to be neglected.

Co-operation on the part of neighbouring landowners is, we think, the best solution of the nursery problem. Several proprietors determined on forest renovation, the rest is easy. A good site could be selected, in a central position, where all those interested can see what is going on.

Each owner could give a guarantee as to the number and varieties of plants he would require annually, according to the nature and scope of his proposed plan of operations, and this would allow of the scheme being worked under competent management, and would give all the estates concerned, whether small or great, the decided advantages of a home-nursery.

Co-operation might also be extended to the establishment of sawmills, or other industries, and the disposal of forest

* It is only fair to point out that the reputation of some Irish nursery firms stands very high, as the considerable export trade they do with England testifies.—A. E. M.

30 Present Condition of Irish Woodlands.

produce. Even the timber-merchant might be induced, by an attractive lot, to enter some of our almost inaccessible districts, if two or three owners would offer lots simultaneously. At any rate, owners working in concert could often negotiate better terms for timber on sale; and there would be a decided tendency towards establishing some uniform system of measurement and disposal, instead of the haphazard and rule-of-thumb methods which generally obtain in Ireland at the present time.

If renovation of woodlands is to be successful it should be carried on, if possible, without interruption. Continuity of action is absolutely essential to preserve interest in the operations.

Those of us who are engaged in practical forestry in Ireland experience great difficulty in procuring the necessary skilled labour to carry on the various operations connected with forest work. Even among the very best and most experienced of our workmen there is a general lack of that personal application to detail which tends to good results.

The more intelligent of our young fellows ought to be encouraged to look upon forestry as an industry which offers some prospects of advancement. The prevailing idea at present is that it is only "labourer's" work, and may be the means of raising a passage to America, or of filling up time till something turns up, but otherwise it is not worth bothering about. But there are lots of openings in the country at figures considerably over the labourer's rate of wage, if suitable men could only be found to fill them. The training is not necessarily so elaborate as some of our Scotch and English friends so strenuously advocate: a little more attention to elementary education, so as to cope with simple accounts and book-keeping, etc.; the cultivation of discipline and regularity, with a taste for doing little things really well.

So much of the work to be successful demands method and system, that any young fellow who means business must make up his mind to take a lively interest in everything that is going on. In outlining a policy of "estate forestry," it may be asked: Do we look for *any* assistance from the Government? Certainly we expect the Technical Education Department to extend to us their practical help and sympathy at least to the same extent as it has been afforded to our sister

industries, "agriculture and horticulture." Large premiums have been given for the improvement of all kinds of stock, and valuable opportunities exist for acquiring education in the various principles of those subjects. Similar premiums could be spent very profitably on the cultivation of forest plants, and on silvicultural improvements, as well as on the establishment of forest industries. On estates where a serious attempt was being made to accomplish something, the men should be given the advantages of technical education on lines likely to stimulate their interest in forest work, and fit them for something better than the labourer's wage and outlook. Landowners might also be encouraged by granting them rebatement of rates on wooded areas which are proved to be undergoing the process of successful renovation. Another very important branch of "estate forestry" is, of course, the extension of our woodland area, planting of wasteland, etc.; but if the system of renovation were generally adopted and judiciously carried on, extension and development would follow as a matter of course, as soon as circumstances would permit. But as silviculture stands with us at present, it is, we think, advisable to tackle our existing area of woodland, and at least attempt to place it on an economic and satisfactory footing before we further increase our wide and rather irksome responsibilities.

A few years of sound forest renovation would prove our capabilities and considerably increase our experience. Then, when the day dawns which brings us that long-expected beneficent Government, laden with its spare millions, we can instantly claim their trust, and confidently proceed to spend their money to the very best advantage in reclothing the naked hillsides of Ireland.

CASTLE COMER.

ALEXANDER MCRAE, *Forester.*

Official Papers.

SUMMER MEETING

Royal English Arboricultural Society.

EARL BATHURST'S WOODS NEAR CIRENCESTER.

ON the 13th August we left Cheltenham for Cirencester, and Mr. Robert Anderson, Earl Bathurst's agent, and Mr. Harrison, the woodward, met the party at Cirencester House. Mr. Leddet, the Conservator of Forests from Paris, came with Mr. E. Stafford Howard, Commissioner of Woods. On entering the grounds, the magnificent yew hedge, which is 30 feet high, attracted attention. Its age is unknown. One of the two large horse-chestnut trees on the lawn girths about 12 feet 10 inches over bark, 5 feet from the ground. The branches have reached the ground and taken root, producing a crop of subsidiary trees covering an area of about 2,000 square yards. The largest cedar of Lebanon girths 15 feet, and a fine beech, 15 feet 7 inches over bark, 5 feet from the ground.

At Cirencester the soil is tenacious, the geological formation being the forest marble of the Great Oolite series, in which thin bands of hard rock are intercalated with clay. In the Home park are many fine elms. The altitude is here about 370 feet, and the park extends in a westerly direction for about 6 miles, reaching about 560 feet above ordnance datum at the ridge forming the water-parting of the Thames and the Severn. Half a mile from the house the soil becomes a light stone brash, not more than 6 inches deep, on oolitic limestone rock.

We visited one of the nurseries that contained beech and

larch plants of various ages and a bed of Sitka spruce. Considerable damage had been done by the cockchafer grub to both beech and larch, and some beech seedlings sown in 1906 had been frosted, but were making good growth.

We met the carriages in the broad avenue, 6 miles long, that runs due west from Cirencester to Sapperton. On either side are fine beech with a few trees of other species in high forest, and in the neighbourhood of Pope's Seat there is an excellent naturally regenerated undergrowth of beech, sycamore, and ash. The beech standards are mature. Some cleared spaces, where there was no undergrowth, had been enclosed and planted up with seedling beech and larch. From these spaces twenty-four beech trees had been felled in the previous winter, and sold by auction. They measured 2,857 feet quarter-girth measure, including branches, and were sold for £203, rather more than 1s. 5d. a foot, the purchaser paying the cost of felling.

The party divided at this point, the President, Mr. Elwes, conducting one detachment to see what is perhaps the most remarkable tree in Earl Bathurst's park, the Service tree of Fontainebleau, *Pyrus latifolia*, which is fully described in "The Trees of Great Britain and Ireland," page 158. This tree, though in most places believed to be a hybrid between *Pyrus Aria* and *P. terminalis*, has developed into a species in the forest of Fontainebleau, from whence this specimen may have been brought when Lord Bathurst's park was laid out in Queen Anne's reign. It measures about 75 feet high by 11 feet in girth, being much larger than any other of its kind known in France or England. A tree very like it, but much smaller, is found on the banks of the Wye, near Symond's Yat, where both its presumed parents grow wild. A large stool of this was seen in High Meadow Woods on 15th August, 1907, growing within twenty yards of a bush of *P. Aria*, from which it was easily distinguished by its larger leaves much less white on the underside. The tree at Cirencester produces fertile seeds, some of which have been raised at Colesborne as well as at Tortworth and Cirencester.

From here we walked to the "Cathedral Firs," composed of spruce closely planted (about 1780) on the verge of a narrow avenue, a similar avenue crossing at right angles. The trees,

which are about 100 feet high, have been much damaged by wind, but there is still a resemblance to the pillars in a cathedral aisle.

Meanwhile the other division proceeded through the Sweet-hills plantation of pure beech of about 70 years' growth through Mosses' Copse of old beech trees now quite mature, and entered Oakley Wood. This is similar in composition to Hailey and Overley Woods that adjoin it, and which form part of what was styled in the Pipe Roll of 1130, the Forest of Cirencester, and which is there stated to have brought in annual profits amounting to 40s. These woods are of even greater antiquity, since, according to Domesday Book, even in the Confessor's time "part of the render at Cirencester was food for the King's hounds." *

Oakley, Hailey, and Overley Woods now comprise about 2,000 acres of beech, oak, and larch standards over ash, hazel, sycamore, and other coppice. They are treated systematically, a compartment of about one-twentieth being cut every year, together with some of the standards growing thereon. The coppice is worth about £6 an acre at 20 years' growth, and the last few years about 80 feet of beech, 100 feet of larch, and 40 feet of oak standard have been cut per acre. The oak is of poor quality, owing to the unsuitable nature of the soil, which also is not deep or moist enough for ash timber, and owing to its limy nature will not carry sweet chestnut or Douglas fir, except in favoured situations.

In the neighbouring Stroud Valley are several mills at which home-grown timber of every description is converted, and the greater part of the timber and coppice from the Cirencester woods is bought by dealers from that locality. The beech is used for pianos, plane-stocks, tool-handles, furniture, brush backs, and umbrella-sticks. Larch is utilized for railway work and canal-boats, besides a quantity worked up for estate purposes, and coppice is made into toys, bobbins, walking-sticks, reels, and numerous small articles, the ash poles being converted into sheep-hurdles, for which there is a good and constant demand. Some of the best of the oak is sold to

* *Vide* Dr. Nisbet's article in the "Victoria History of the Counties of England."

wheelwrights and implement makers, and the rest used for gates and fencing material.

The value of coppice is fairly maintained in this district, owing to the demand from the mills, but damage by rabbits has reduced the returns from the Cirencester woods much below those that prevailed thirty years ago. Sycamore and birch are not immune, but are the last to be attacked, though they are gnawed when snow is on the ground and no other food is available. Several wired-in plots were seen where there was an excellent natural regeneration of beech and ash, and in one that we did not visit there are, we were informed, a number of self-sown larch. If the rabbits were kept down it is evident that not much artificial re-stocking would be necessary.

The most profitable standards in these woods are the larch, which were referred to in Mr. Fisher's recent lecture at the Carpenters' Hall. These are special trees, and sell at about 1s. 3d. a foot, quarter-girth measure. Several very fine larch, standing round a small clearing close to the "Woodhouse," were seen. Two of these, illustrated in "The Trees of Great Britain and Ireland," were estimated to contain 135 and 150 feet respectively, at quarter-girth measure.

We were splendidly entertained at luncheon by Earl Bathurst, at the "Woodhouse," or "Alfred's Hall," a picturesque building erected by the first Earl about 200 years ago. An inscription informed us that at this spot King Alfred and Guthrum the Dane made a treaty. There is no evidence in support of this, but the Danes were undoubtedly in Cirencester in A.D. 878, after their defeat by Alfred at the battle of Edington.

Two fine boards of larch and Scots pine were on view in the Hall. These were grown in the Cirencester woods, and gained awards in the Forestry Exhibition at the Bath and West of England Show at Newport.

After luncheon we walked to the Park Corner Ride, where we saw a fine *Pyrus terminalis*. Thence to the spot called the Ten Rides, where the ten broad avenues converge, passing some fine *Lawson's Cypress* planted about forty years ago as avenue trees among the beech, several of which are now about 45 feet high.

After walking down Ash Path, where a good natural

36 Earl Bathurst's Woods near Cirencester.

reproduction of ash was noted, the "Horse Guards" plantation of 1893 and 1894 was visited. This was planted on arable land after a root-crop, the trees being 5 feet apart. It is practically pure larch, most of the beech planted with them having been destroyed by rabbits when the wire was removed in 1900. The trees are about 25 feet high, and although many blisters of *peziza (Dasyscypha)* are to be seen on the branches, and some on the stems, they are growing vigorously. Some years ago this plantation was much damaged by squirrels.

Adjoining are two younger plantations planted in 1904 and 1905. The area is about 25 acres, and the greater part is beech and larch four feet apart in alternate rows. A small portion is larch and sycamore. These plantations were made upon land that had been under grass and sainfoin for sixteen years, and although it was cropped with corn and summer-fallowed, being repeatedly dragged with steam tackle, such a growth of grass and weeds appeared during the first season that the ground was hand-hoed twice and afterwards horse-hoed. This year it was again hand-hoed and horse-hoed, but the trees having become established this was not necessary for their well-being. Hand-hoeing costs 20s. an acre, and horse-hoeing 3s. an acre. Although the plantations are most thriving the expense of hoeing is very considerable; it might possibly be better to clear the grass entirely by a succession of agricultural crops, and then manure with basic slag before planting. Grey alder is most thriving at Colesborne on somewhat similar soil, and a crop of this with a rotation of say, ten years, would clean the soil thoroughly and prepare the way for better species. The adoption of such a course would, however, delay the formation of the plantation a good many years, and on that account would probably not be favourably considered by English landowners. Extensive experiments on the most economic ways of planting abandoned agricultural land have been made in Belgium, and similar experiments in this country would be valuable.

We have to thank Earl Bathurst for permission to see the woods, Mr. R. Anderson and Mr. Harrison for conducting the party, and Mr. Smith Hill, Mr. Osmond Smith, and other friends for their notes from which this paper is compiled.

THE ROYAL AGRICULTURAL COLLEGE
FOREST-GARDEN.

THIS was visited after the party had seen Earl Bathurst's woods.

The garden was started in 1903. It occupies about 6 acres of land, lent by Earl Bathurst, formerly in sainfoin and grass. There are ten numbered plots of half an acre each, the planting of which was designed by Professor Schlich, F.R.S., and the following account of these is condensed from the Forest-Garden guide prepared by Professor F. C. McClellan :—

Plot 1.—Method of planting, triangle, $3\frac{1}{2}$ feet apart ; description, mixed wood ; half of plot, Norway maple and beech ; half, sycamore and beech ; object, to grow Norway maple and sycamore with the assistance of beech.

Plot 2.—Method of planting, triangle, 4 feet apart ; description, mixed conifer wood ; section A, alternate rows of Corsican pine and European larch ; section B, alternate rows of Scotch pine and European larch ; section C, alternate rows of Corsican pine and common spruce ; section D, alternate rows of Scotch pine and common spruce ; object, to illustrate a common method of mixing two conifers by alternate rows of each.

Plot 3.—Method of planting, square, 4 feet apart ; description, a pure spruce wood ; section A, Sitka or Menzies spruce ; section B, common or Norway spruce ; object, the locality is not suited for spruce, but the plot will illustrate increment and volume of thinnings as compared with better spruce soils.

Plot 4.—Method of planting, 4 feet apart ; description, a pure larch plantation ; section A, Japanese larch ; section B, European larch ; object, to illustrate the growth of the European as compared with the Japanese larch, and later on the underplanting of a pure larch-wood with beech.

Plot 5.—Method of planting, square, $3\frac{1}{2}$ feet apart ; description, a pure pine planting ; section A, Corsican pine ; section B, Scotch pine ; objects, to illustrate the growth and yield of a pure pine-wood, to compare the Scotch with the Corsican pine,

and later on to illustrate the underplanting of a pure pine-wood with beech or lime.

Plot 6.—Method of planting, rough triangle; 4 feet apart; description, various exotic trees occurring more or less commonly in British silviculture; section A, black walnut; section B, *Fraxinus Americana*, *Oregona* and *viridis* with intermediate rows of beech; section C, acacia; section D, sweet-chestnut, yellow birch, and black cherry; section E, American elm; section F, grey alder.

Plot 7.—Method of planting, square, at different distances; description, a pure oak plantation; sections A, C, and D, sessile oak; section B, pedunculate oak; objects, to illustrate the formation of a pure oak wood by planting, and the effect of different planting distances; will be undersown with beech.

Plot 8.—Method of planting, triangle, 4 feet apart; description, pure planting of three species of conifers; section A, Sitka cypress; section B, Lawson's cypress; section C, giant Thuya.

Plot 9.—Method of planting, line-planting, plants 40 inches apart in line, lines 80 inches apart; description, preliminary planting of light-foliaged trees for the purpose of giving shelter to other trees planted later on; section A, half European, half Japanese larch; section B, half common birch, half paper birch, *Abies concolor* between the lines; section C, acacia, Nordmann's silver-fir between lines; object, to raise silver-fir under the shelter afforded by the light shade of other trees that have had a start given to them.

Plot 10.—Method of planting, triangle, 4 feet apart; description, mixed plantings of two species in alternate rows; section A, Norway spruce and beech; section B, Scotch pine and beech; section C, large-leaved lime and hornbeam; section D, small-leaved lime and hornbeam.

The college is a fine picturesque building, in early Tudor style, and resembles an Oxford college. The party were most hospitably entertained at tea in the College hall by the Principal, Rev. J. B. McClellan, and the Council, none of whom were, unfortunately, able to be present. Mr. H. J. Marshall, of Ross, an enthusiastic forester and a former student, took the chair, and Professor Blundell responded on behalf of the College to the vote of thanks that was proposed by Mr. Elwes.

COLESBORNE.

ON the 14th August, Colesborne, the estate of Mr. H. J. Elwes, F.R.S., President of the Society, was visited.

Leaving Cheltenham at 9 a.m., the party were met at Charlton Hill by Mr. Elwes and Mr. Irvine, forester on the estate. Here the party divided; those wishing to study larch-blister and general forestry got off the brakes in order to have a long walk through several plantations, and, as each in turn was arrived at, Mr. Fisher kindly read the notes given to him regarding it. Mr. Elwes had explained in these notes that, by reason of the poor soil combined with agricultural depression, much of the land would not let; hence many of these plantations were formed on ground that had formerly been cultivated. Having spent a good deal of money in this way, from which he was not likely to reap much benefit in his lifetime, Mr. Elwes, in naturally trying to make the best of things, found, some years after planting, that a considerable revenue might be annually derived from rabbits, which then were bringing in the high price of 1s. to 1s. 4d. each. Consequently, these pests were allowed to increase largely, as Mr. Elwes argued that they were yielding him a fair yearly rental, and all timber that might survive their depredations would be an additional profit. This acted very well for some years, but now that rabbits are selling at something like half the price given above, and seeing that the woods have suffered greatly from their ravages, while much of the larch is infested with disease, the profit at present seems questionable indeed. The greater part of the forestry work here has been carried on under great difficulties, both of soil and climate, and it says much for Mr. Elwes' energy and interest in forestry that he still goes on perseveringly in trying to set an example to other proprietors. Many of the plantations are situated on hot, dry, and steep hillsides, where a very thin and poor soil overlies the oolitic limestone. Others again have been formed in hollows, where much damage is done by spring-frosts. However, every step of the way was interesting, and many lessons could be learned.

Following are rough notes on the plantations visited:—

Whistley Plantation.—About 90 acres. Was planted by contract in 1882 to 1885, after a crop of wheat, with larch and a few Corsican pines. This plantation is situated on very shallow soil, overlying the oolitic rock, on a rather steep hill-side rising to a flat plateau on the top, with aspects towards the south, south-west, and south-east. The crest of the hill is probably about 800 feet above sea-level, and is not unduly exposed, as many of the surrounding hills are of about the same altitude. Notwithstanding the damage caused by rabbits and disease, the plantation has grown fairly well, the average height growth being about 25 feet, with a diameter of 5 inches at the butt. The Corsican pine have mostly died out, only a very few remaining. This tree is difficult at all times to transplant, and the result may have been from this cause, or from the limestone not being suitable, as was suggested; but we have seen this tree doing well on limestone in other parts of the country. This plantation was never enclosed with wire-netting against rabbits, and as after planting, rabbits were considered as a profitable source of revenue, they have done much damage. A larch tree standing alone, which measured 25 feet high, by 8 inches diameter at the base, was seen peeled round and killed by the rabbits, although in perfect health last year.

Disease was very prevalent—indeed, it was almost impossible to find a tree free from it. The cause, after many conjectures, was assigned (1) to rabbits; (2) the southerly aspect; and (3) that on such an aspect it is not judicious to plant a crop of pure larch. Trees were here shown with larch-blister in course of fructification.

A suggestion being made that lime in the soil may be the cause of disease, Mr. Fisher remarked that he has found larch, with beech, growing at Weston-super-Mare, on mountain limestone, without a trace of disease. Mr. Braid, forester to Lord Dudley, Worcestershire, stated that they had beautiful larch, nearly a pure crop, free from disease, grown on calcareous soil.

This plantation had been lightly thinned in 1905, when the poles taken out realised £2 per 100, being used locally for

fencing and rustic work. The majority of the foresters present were of opinion that the best future method of treatment would be to thin out the worst of the larch heavily and under-plant with beech. There are now about 1,000 larch per acre, so that the value of the thinnings might well cover the cost of netting and underplanting, and still leave a fair crop on the ground.

Chatcombe Wood.—About 120 acres. Coppice-with-standards. Consists partly of old beech- and lime-stools, which have been coppiced at about eighteen years for over 100 years, with a few larch planted about forty years ago, clean, and of fine growth. Much of the coppice had been damaged by rabbits, but the lime (small-leaved variety) had not been touched, as the bast is furry, tough, and clogs their teeth.

An experiment was tried here, about twenty-five years ago, to convert part of this wood into high forest by leaving the best ash poles standing on stools, but this has not proved a success, as the poles are not much larger than when left. Beech poles similarly left are growing well.

It is now proposed to clear this wood in blocks of about 10 acres annually, leaving only the best standards, planting up to 5 feet apart with ash, larch, and other trees, to grow into high forest. A portion was seen already wire-netted for this purpose—a necessary precaution—as this wood is, and has been, heavily stocked with rabbits.

This plantation is more in the valley, and some of the members, being asked, gave their opinion that a little draining might be beneficial, and to use oak and ash as the principal crops, coniferous trees as nurses, to come out in thinnings at an early stage, and mixed with beech and hornbeam to act as nurses later on. Mr. Elwes does not consider drainage necessary, or that hornbeam would be useful here.

Rough Banks.—21 acres. Planted in 1878. Mostly pure larch. Trees are now about 30 feet high, with a diameter of 9 inches at base. This plantation is situated on a good loam, in a valley with two slopes, the one facing north showing a much better growth than that facing south. Most of this wood carries a fair crop of poles, but disease is prevalent in places. It was thinned in 1906, when the poles sold for £2 to

£3 per 100. Notice was taken that the rank grass cannot be suppressed on this land by larch alone. Mr. Elwes says that neither sheep nor rabbits will eat this coarse, wiry grass.

Brown's Hill.—7 acres. Planted in 1871 with pure larch. Disease is very bad in this plantation, hence no regular thinning has been done, and only dead poles taken out. The wood is now hardly worth thinning, so that probably the best thing to do would be to clear and replant with other species.

Hilcot Wood.—124 acres. The members had no time to go through this wood, but contented themselves with walking along one side of it. It consists of coppice-with-standards. The coppice is being cut over, the best standards being left, and filled in with larch, sycamore, and ash. Each tree is surrounded with a protective wire-netting guard against rabbits, costing about 2d. each, of which there are 6,000 in this wood. A cheaper and better plan would be to enclose the wood in blocks, but for the fact that it is now heavily stocked with rabbits, and realises a fair rent for shooting.

This wood has been recently enlarged by taking in some adjoining fields, planting up with larch and beech, which are doing fairly well, but the larch planted in 1902 have been badly attacked with *Chermes* this season.

Mercombe Plantation.—Planted in 1855. Aspect, S. and S.W. The crop of larch was felled in 1906—7. 2,600 trees (about 40,000 cubic feet) on about 20 acres realising 9½d. per foot standing, the buyer having to do the felling. Good timber, with clean boles. Fifty years is fully long enough a rotation for larch here.

Some wych elm poles, straight and tall from the close growth with larch, have been left on the ground, but should now be felled.

The visitors were asked to suggest the best course to adopt on replanting this wood, as doubts were expressed as to whether, on this poor ground, larch would succeed after a larch crop.

Most of the members were of opinion that it would not be advisable to replant with pure larch, but that larch with beech would probably give good results.

There is a forty years old crop of trees on the N.W. aspect of the same combe; a larch measured 10½ inches quarter-girth and 60 feet in height.

The other party, in driving to Colesborne, had inspected Chescombe plantation, about 60 acres, made in 1880—1, on land gone out of cultivation, that had previously grown wheat. This plantation has never been protected from rabbits, and has been let with the adjoining farm for fifteen years as a rabbit-warren. The larch here have suffered badly from spring frosts, poor soil, and the attacks of *Coleophora laricella*, *Chermes*, and *Dasyscypha calycina* (*Peziza Wilkommii*), which last is very prevalent here. It was remarked as curious that some rows of trees are quite sound, while others are badly infested with the disease. Whether this is due to bad planting or other cause is a matter for conjecture. Even here, were forestry alone to be considered without regard to profits, thinning and underplanting with beech might even yet give good results.

Cockler Plantation.—Formed in 1882 on land previously arable. Consists of larch and hardwoods. Owing to better soil, cooler aspect, and probably too in part from the benefit derived by the humus formed from the leaves of the under-planted beech, this plantation has done much better, and carries a good crop of nice clean poles, the larch being now nearly free from disease, though it suffered when young. Owing to previous success this plantation was extended in 1903—4 by planting about 100 acres of adjoining land, mainly with larch and beech, at distance of 5 feet apart; but this extension, owing to many causes, such as planting by contract, badly rooted plants, dry spring, with severe frosts on May 20th and 21st, 1905, has many blanks, which at present have been only partially filled. The pruning in the older plantation was excellently done, close to the stem, and the wounds are rapidly healing. Probably on dry banks like this it might be an advantage to introduce beech, after the larch has had some years' start.

Lyde Valley.—Partially cleared of mature and scrubby timber in 1901-2, and has been planted at various intervals before and since, with many kinds of trees, as an ornamental and experimental plantation. Many of the varieties have suffered severely from the spring and autumn frosts so prevalent here. These injured plants include beech, ash, Douglas fir, etc.; but *Chamaecyparis Lawsoniana* and *C. Nootkatensis* seem untouched.

Just before lunch we saw some magnificent beech, about 100 years old, with upwards of 100 cubic feet in each tree.

The splendid crop of larch, spruce, and beech, near the stream and ponds, the larch being close to the water, is up to 120 feet high and over 100 years old.

Many of the members had meantime seized the opportunity of visiting the gardens, which contain a magnificent collection of herbaceous plants, many of the varieties being of Mr. Elwes' own raising. During a hurried look round the following, among many, were noted: *Allium Cyaneum*; *Calceolaria plantaginea*; *Campanula Carpatica*, "Riverslea"; *Campanula versicolor*; the stately *Eremurus*, in varieties; *Dryas octopetala*; *Gentiana Davidii*; a gorgeous display of *Gladioli* in many varieties, a special attraction being hybrids in violet and blue shades, the variety Baron Joseph Hulot being exceptionally fine; *Lilium Dalmaticum* and other varieties; a grand lot of Mexican poppies; *Oxalis Vespertilonis*; Primulas of many kinds; *Romneya Coulteri*; *Spiraea Aruncus Kneiffi*; *Verbena Mahonetti*,—a beauty; and *Wulfenia Amherstiana*.

Lunch was provided in a large marquee erected by the side of the fish-ponds, Mr. Elwes presiding. After ample justice had been done, Mr. Elwes was cordially thanked; and, in reply, stated that he had been an enthusiast in many things in his life, but that forestry would, in all probability, occupy him for the remainder of his career. He had not been ashamed to show them his failures as well as his successes, and expressed the hope that they would learn something from their visit of what was possible, what was economically worth doing, and what was not, on soil and climate of such an unusual character as this. He did not like the estate to go down to his successors as a mere rabbit-warren, and he had therefore made the enclosures they had seen. It was a question not yet decided whether the growing of timber on such an estate as his would be successful; but if only one man in a county, or group of counties, would try, he was sure they would learn a great deal. He did not believe in buying everything from Norway, when so much timber could be grown and utilised in our own country.

After lunch we proceeded up a steep hillside, containing some very fine Scots pine timber, which, we understood, it is

contemplated to clear and replant. Doubt was expressed whether Scots pine would do well here again, but many were of opinion that a successful crop might be raised if grown in mixture with beech. Although it is difficult for outsiders who are unacquainted with local conditions to criticise, yet it was suggested that beech might be more used than it is in many of the plantations, seeing there is so much lime in the soil. This has been done in all new plantations. Most of the varieties employed would benefit from its shade-giving properties, and the soil from the humus formed; while beech would act also as a screen to larch in preventing dissemination of the spores of disease.

A larch plantation we came across, where the trees are standing very thin on the ground, and which had been underplanted at very wide distances apart, about 10 or 12 feet, with beech and spruce, each netted-in separately, met with some criticism, as at the distance planted they will not be of much benefit to the present crop, nor are they sufficient of themselves to make a crop in the future. A good lesson was, however, here to be noted, that in Britain spruce is not the shadebearer it has been represented to be. The beech were in splendid health, and making excellent growth; whereas the spruce were looking sickly, losing leaf, and gradually being killed by the shade of the larch above. Mr. Elwes states that this is only partly true, the soil being too dry for spruce.

Passing on, we came to a small valley, on the slopes of which Mr. Elwes has established an arboretum, in order to test the effects of soil and climate on many species of trees; all raised from seeds gathered in England. This, of itself, is interesting, inasmuch as the parentage of all are known, so that the value of selecting seed from trees of good clean timber growth, instead of buying seed from abroad promiscuously, can be noted for comparison. This is a matter that, we think, has not before received the attention it deserves. We are most particular about the parentage of our farm-stock, etc., and the day is possibly not far distant when the claims of heredity in forest trees will be equally recognised.

The method employed consists of raised beds, made by turning the top spit of soil grassy-side downwards on the unbroken turf, plants being introduced on the raised beds, and also on

the level, for purposes of comparison. The main idea is to leave the best of the trees as standards, and to watch the diversified growth of the various species here planted, which, as noted above, are all from home-gathered seed. Many species of the *Acer* do well, and also the butternut and black walnut. Most of the various kinds of larches are also thriving, some being planted and some sown. Hickory suffers greatly from frost, as also do many of the conifers.

A nice example of frost protection was instanced, where grey alder (*Alnus incana*) has been employed to shelter *Thuya plicata*. Planted four years, the thuvas were 4 feet high, whereas the alder had reached the height of 10 feet in the same time, and gave an admirable example of what might be done in places which suffer from frost, and where species like beech require protection. At present the grey alder is not much known in Britain, and as we were told it would grow in dry and gravelly soils, it will be useful for the above purpose. *Pinus leucodermis* is very useful on dry calcareous soil, and is very easily transplanted. Not a single failure of this variety here. *Abies Fraseri* withstands frost.

We next reviewed the Centenary Plantation, which was enclosed in 1901 and planted in subsequent years. Much of the land is very poor. Plants used were principally larch and beech, at the rate of two larch to one beech; while Scots pine and oak were also tried on the better land. Some of the fields were planted 6 feet by 4 feet, some 5 feet by 5 feet, and 4 feet by 4 feet. Much criticism took place on the size of plants used, and the distances at which they are planted. As many of the local conditions may be unknown, such criticisms should always be given with a certain amount of reserve; but the general opinion seemed to be that smaller plants would give better results, and that the distances apart were too wide to give sufficient branch suppression necessary for the growing of clean timber. However, where the ground is or will be covered with long grass the plants should be fairly large.

Part was also cultivated and sown *in situ*, lines of larch, spruce, and hardwoods being planted for shelter, one row of plants to three rows of seeds. Much of the sowing was a

failure, owing to mice, drought and spring-frosts, only sycamore and a plot of Corsican pine coming to anything, and many of the two-year sycamore are now only about nine inches high. Corsican pine grows well through grass.

Nurseries.—The nurseries are badly situated climatically, and suffer from spring-frosts. One, taken in four years ago, has been severely infested with cockchafer larvae, much damage being done to the seedlings contained. Larch suffered worst, and next Scots pine and beech. Corsican pine seemed to escape. As a remedy, mustard was sown between the lines, and cut off with sickles before it was high enough to injure the plants. The following spring the ground was well dug, manured, and planted with potatoes. This seems to have cured the evil, as very few have been seen since.

This nursery is well kept, and is stocked with larch (a very fine lot), Corsican pine and oak. A curious problem was here presented to the visitors, as part of a bed of oak, transplanted a year ago, did not look so healthy as part of the same bed of similar age, transplanted this spring. No cause could be assigned, as nothing could be found wrong with the plants, but they were somewhat yellow, and looked delicate. The Calabrian pine (2—2), a variety of *Pinus Laricio*, the seed of which Mr. Elwes got from Calabria, is doing well, so are plants of the same variety at Culford (Earl Cadogan), where Mr. C. Hankins states that they will probably prove very suitable for sandy soils.

The other nurseries are well stocked with larch and hardwoods of various ages, together with a fine lot of *Thuya plicata*, and many rare specimens grown from seed by Mr. Elwes. There are several kinds of American ash, including the *Fraxinus Oregonia*, *F. viridis*, and *F. Americana*. All are looking well. The Japanese elm—*Zelkova Keaki*—suffers from spring-frost.

Proceeding to Mr. Elwes' mansion, tea was supplied and presided over by Mrs. Elwes and Lady Carrington. Here were to be seen many trophies of Mr. Elwes' prowess as a sportsman; big game from many lands being fully represented by valuable heads, horns, and skins.

A grand collection of British and foreign timbers, and furniture made from the same, exhibited by Mr. Elwes, came to

most of the society as a magnificent surprise ; and many and worthy were the comments thereon. This splendid collection consists of specimens of about 74 kinds of hardwoods and 35 of coniferous timbers, from all parts of the world ; and is a forestry education in itself. In most cases a board from the natural habitat of the tree was shown for comparison along with one of the same kind of timber grown in this country. The lesson in all cases was the same. Whereas our previous methods of forestry, with wide planting and heavy thinnings, have succeeded only in growing timber of open and coarse grain, with big, rough knots ; the foreign, or native plank, is close-grained, firm in texture, and of a quality and colour undreamt of by those who have only seen the home product of many of these timbers. This is entirely due to close-growing, or branch-suppression ; and, should there be any one rash enough to doubt modern methods of thick planting and close-growing, let him visit Colesborne Hall, and we feel sure he will be a "doubting Thomas" no longer. An excellent specimen of a farm-gate was also shown, and favourably commented upon. Head and heel were of oak, with larch bars. Two rough gates of split materials were likewise exhibited, one made from ash poles, the other from Wych elm, which latter is said to last well, but liable to twist.

Mr. Elwes' splendid work on arboriculture, written in conjunction with Mr. A. Henry, was also on view, and copies of a specimen part on the common oak were presented to the members present.

A short walk through the home-nurseries and gardens, for the benefit of those who had not previously seen them, brought a most eventful day to a close.

In compiling these notes, I have been indebted to Mr. Smith Hill, Mr. R. G. Forbes, of Tavistock, and Mr. Osmond Smith.

J. P. ROBERTSON.

HIGH MEADOW WOODS.

Mr. Stafford Howard, C.B., Commissioner of Woods and Forests, and Mr. Leddet, Conservator of Forests from Paris, accompanied us through the High Meadow Woods, which are the property of the Crown, and comprise an area of 3,285 acres, situated on the river Wye, between Ross and Monmouth.

The largest compact area of 2,949 acres lies on the south of the Wye, and contains several deep sheltered valleys draining in a general north by north-west direction to the river, the altitude varying between 70 feet and 750 feet above sea-level.

The geological formations are on the east. The coal measures with a yellow loam overlying beds of stiff clay, followed towards the west by the old red sandstone, which produces a deep sandy loam specially adapted to tree growth, and particularly for oak. To this succeeds a broad band of limestone, followed by the millstone grit, the soil of which, mingling with that of the limestone, improves it in depth and porosity, affording the best conditions for the growth of ash, as shown by the splendid reproduction and vigour of individual poles in Skeret's block, which the party visited at the end of the day.

The woods are managed under a working-plan prepared in 1897 by the late Mr. H. C. Hill, Inspector-General of Forests to the Government of India. Leaving 999 acres to be worked for the present as coppice-with-standards, his plan provided for the ultimate conversion of 2,242 acres into high forest, and an area of 678 acres was to be so converted during the first period of thirty-five years, for which alone detailed measures of treatment were provided. In these 678 acres cleanings were prescribed to free the crowns of oak, ash and larch in danger of being smothered by the more rapid-growing beech, lime, wych elm, etc., of the underwood, also thinnings for the removal and utilisation of all suppressed stems that were not needed to complete the canopy. In the remainder of the area not ready for immediate conversion, the coppice rotation was to be raised to thirty-five years, and the number of standards recommended was 75 per acre, 40, when available, being of the same age as the ripe underwood, viz., thirty-five years.

However, when the writer of these notes visited these woods

in November, 1903, he found that owing to the low price of cordwood, and other reasons, the plan had already been to some extent modified, by the partial conversion of these temporary coppice areas into high forest by planting larches in the blanks and the reservation of as many young tellars as possible, especially where seedlings and poles of ash were abundant, as in Skeret's Wood.

By raising the rotation of the underwood to thirty-five years, beech, ash, lime, and other species will be favoured at the expense of the hazel, which in those parts of High Meadow Woods destined to conversion into high forest is looked on as a weed to be got rid of.

The party left Cheltenham on the 15th August, at 9.20, arriving at Symonds Gat soon after 11. We first passed through Mailscott Wood, twenty-nine years old underwood on limestone, of beech, oak and ash, and some hazel, with standards of oak, ash, and larch. The larch was particularly fine, about fifty years old, with an average girth of over 4 feet and height 85 feet. One larch four years ago, measured 6 feet in girth, with a height of 90 feet. Eastwards, on the sandstone, the oak standards were flourishing remarkably well. Mr. R. G. Forbes suggested planting Douglas fir in places where there is no lime in the soil, and Mr. Popert agreed to try some of this species.

The question was raised by Mr. Elwes whether the deodar (here planted as an avenue tree) did not succeed best in the long run on limestone soils, though its growth in others may be faster at first. Those that we noticed seemed to confirm this view. On leaving the old underwood we passed through a series of cuttings in clay, made during the last eight years. Blanks have been filled chiefly with larch, while standards have been grouped as far as possible, thus hastening the conversion into high forest. Where only a few good oak standards have been found with a majority of badly shaped or decaying ones, the whole have been removed. The treatment at the end of the thirty-five years for which the plan is formed will probably be to clear the larch and sell it as pit-props, also all clumps of old oak, and replant as an oak wood to be mixed with beech.

The larch appeared thriving and fairly free from disease. In wet areas, along a line of springs coming out of the coal measures on the eastern boundary, spruce had been planted instead of larch, and these also had done very well, some of the year's shoots being 3 feet long and more. Beech had not been introduced as much as was considered theoretically advisable, owing to deficiency of mast and difficulty of raising enough plants in flying nurseries adjacent to the yearly cuttings. In Mailscott, though there is plenty of beech in the underwood, yet there are few, if any, standards available as seed-bearers, and seedling beech, therefore, when required, will have to be introduced by planting, an expensive operation compared with natural regeneration, which is usually sufficient in high forest of this species when rabbits are kept in check.

Speaking of rabbits, damage had at one time been frequent in the past, as evidenced by the description of the different woods in Mr. Hill's working-plan, where oak, ash and larch standards planted twelve to twenty years ago are noted in many places as "mostly destroyed by rabbits," "damaged by rabbits," and so forth. Rabbits are now kept well in check, being treated as vermin and shot at all seasons of the year.

We noticed an acre of old nursery at the top of the hill carrying a crop of pure larch; they were forty-five years old, and are estimated at 3,000 cubic feet per acre. Though only five years younger than those already passed in the valley they had made comparatively very poor growth. The treatment recommended in the plan was to undersow with beech, which has not yet been carried into effect. In the south of England generally, it seems as if pure larch woods at moderate elevations are often failures as compared with what can be achieved in Scotland, when required to produce timber beyond pit-prop size; but when grown as standards in old coppice, as in High Meadow Woods, or in mixture with beech, as on Earl Bathurst's estates near Cirencester, very fine larch can be produced equalling the finest in Scotland for size, while growing at a very much quicker rate. One solitary larch standard on Woodcastle Hill, in a plantation of oak and larch, with irregular underwood, measured 9 feet 11 inches girth, at 5 feet. The clear bole is 38 feet girth, at middle, 8 feet

6 inches, which, after allowance for bark, measures 140 cubic feet, or about 200 for the whole tree, estimating 60 cubic feet for the top. The height was 95 feet, and the age between eighty and eighty-five years.

Before coming to Woodcastle Hill we passed through a twenty-two years old coppice of beech and hazel with oak standards on loam over the broken sandstone of the coal measures. It is noticeable that throughout the High Meadow Woods ash occurs chiefly on the limestone formations, as is the case in Somerset on the Mendips, reaching perhaps its finest development where it borders on the millstone grit. We then passed through eighteen years old coppice with oak and larch standards, in a corner of which, where the standards were mostly evenaged and about eighty to eighty-five years old, occurred the larch whose measurements have just been given. We descended the hill towards the river through a coppice mostly beech, with a fine overwood of oak; several young oaks too had been interplanted. This, with the acre on Woodcastle Hill, will be allowed to grow on as it is, into high forest, the young oaks and ashes being carefully cleared. The standards have a fine length of stem, showing what oak can do when grown on a sandy loam with a mixture of beech.

Arrived at the bank of the Wye again, we found lunch waiting for us in a place called the "Slaughter," for over 1,000 years the traditional site of a bloody battle between the Welsh and the Saxon invaders, though it does not appear to have been recorded in history. After lunch, it was apparent that the part of the programme relating to the walk through the Great Doward Wood, on the other side of the Wye, would have to be abandoned. So we toiled up a steep hill after passing through a series of recent cuttings of coppice-with-standards (destined for ultimate conversion into high forest) to the top of the hill in Skeret's Wood, where on the limestone there was a magnificent reproduction of ash. Advantage is being taken of this to convert the wood at once into high forest, the coppice-shoots when they interfere with the seedlings being regularly cut back until the latter are out of danger. When the copse was cut many fine seedling ash poles were discovered; these were nearly all reserved, and it is hoped that, together with the

younger recent reproduction, the whole will grow on into ash high forest. Probably beech will be introduced later where it does not already exist in sufficient quantities, for otherwise it is somewhat doubtful, as the underwood no longer shelters the soil to the extent that it formerly did, whether the ash will thrive so well in the future as they evidently have done up to the present. The ash here suffers from the ash tortrix moth.

Here, Mr. Stafford Howard, by whose kind permission the visit of our party to High Meadows had been arranged, left us. The rest of the party walked on along a path on the brow of the hill affording a magnificent view over the lovely valley of the Wye, which between Ross and Tintern contains some of the most beautiful scenery in England, and in its own style is not to be beaten in Europe. There were some fine old beech standards along the path, which are being reserved partly for their scenic effect, also as seed-bearers ; for, as has already been mentioned, it is desired to replace hazel underwood by beech seedling forest as means and opportunity permit, and large standards affording a sufficient supply of mast are rare. Besides ash ; beech, and oak, maple, service tree, aspen, birch, willow and wych elm are all well represented. A few of these are left as standards. For the rest, except perhaps for maple, they are best excluded from the underwood. We then descended towards the river through Lady Park Wood. Here two old nurseries of three acres each had been left and allowed to grow up with larch, oak, chestnut and a few self-sown birch. These patches have not been coppiced over, but are being allowed to grow on into high forest, the only treatment required being to thin out to about 400 stems an acre, and underplant with beech. Arrived again at the "Slaughter," we walked back along the river to Symonds Gat, and leaving about 4 p.m., reached Cheltenham in time for a well-earned dinner at 7. All the ivy is cut from around the trunks of the trees, and Mr. R. G. Forbes states that ivy ruins the quality of oak timber, so that in many cases timber-merchants won't buy it standing.

Our thanks are due to Mr. Popert, assistant surveyor of the Forest of Dean, who conducted us through the woods and explained all the different operations and the objects which they were to attain ; also to Mr. Hanson, of the Forest of Dean

school for woodmen, who also accompanied us, and was a mine of information for some of the more active enquirers of our party.

So ended a very pleasant and instructive day, when the process of conversion of coppice-with-standards into high forest was fully explained to us in its different stages and exemplified by sound silviculture and evidently economic practice.

Mr. R. G. Forbes gives the following notes as regards the sales of wood here: The smaller material from branches and underwood is made up into cords for pitwood and for chemical works. The cord contains 128 cubic feet, about two tons, and sold for 2s. The smaller cordwood, about two inches thick, sold at 6s. a cord for chemical works; they cost 4s. per cord to make up, and the larger cords 1s. 6d. besides to carry to the sides. About 15,000 cubic feet of oak is cut annually, and sold at 1s. 3d. to 1s. 6d. per cubic foot. One fine oak of many similar ones, 30 feet in bole and 26 feet 9 inches girth, measured 140 cubic feet. Beech underwood should be cut 6—12 inches from the ground, and one shoot left to draw up sap, as frost kills many that are cut close to the ground. This, Mr. Leddet said, was the plan adopted in France.

A. P. GRENFELL.

NOTES ON THE TREES AT TORTWORTH.

On August 15th, the members of the Society divided into two parties, one section spending an agreeable day in visiting the famous collection of trees at Tortworth, which is especially rich in broadleaved species. All the trees here were planted in Lord Ducie's lifetime, he being now 80 years old. We first proceeded to the Douglas Fir Plantation, an account of which is given elsewhere; but I may note here that one of the trees in this plantation actually measured 111 feet in height and 4 feet 7 inches in girth, almost a record as regards the astonishing proportion of the great height to the slender diameter. Afterwards, at Tortworth Church, we admired the

historic chestnut, which certainly, judging from its appearance, is of great antiquity. In the churchyard we noticed a good specimen of *Carya sulcata*, one of the rarest of the hickories in cultivation; this tree is about 30 feet high, and bore a few nuts in 1905. Lord Ducie has also a specimen of the pecan, *Carya olivaeformis*, 24 feet by 1½ feet, an equally rare species; and a small plant of *Carya tomentosa*, which is perhaps the most ornamental species of the genus, with very large and fragrant foliage.

A small plantation, about two acres in extent, of American ashes, was next inspected. These are planted 12 feet apart, and are about 25 feet high, and consist mainly of *Fraxinus Americana*, there being also a single line of *F. Oregonia*. These ashes are of doubtful economic importance, though *F. Americana*, as grown at Kew, is a very narrow pyramidal tree, very thriving, and differing in habit from *F. viridis*, with which it is often confused. On the lawn in front of the house we observed a good specimen of *F. Americana*, 46 feet high by 3 feet in girth. The American ashes here mentioned are worth cultivating as ornamental trees on account of their distinctive large foliage.

In the grounds there is a considerable number of foreign oaks. About sixty exotic species have been introduced into England, and of these only a few have been successful. The American species, belonging to the white oak section, which includes our common oak, invariably do badly; and I observed at Tortworth the only specimen, which I have seen in England, of *Quercus alba*, the tree which yields the American oak timber of commerce. This was miserable in appearance, being only 20 feet high by 15 inches in girth. Some of the species of the red oak section, which is peculiar to North America, are successful in our climate, as *Q. rubra*, *Q. palustris*, and *Q. velutina*, which thrive and attain a large size in the South of England. At Tortworth there are two fine specimens of *Q. Kelloggii*, one of which measures 40 feet by 2 feet 8 inches. This is the red oak of Oregon and California, and, like most trees from this region, grows well in England. *Q. ilicifolia* is a scrubby oak, rarely attaining 20 feet in height, and is grown at Tortworth as cover, the acorns, which are early produced, being useful as food for game.

Of the other exotic oaks, excluding well-known species, like *Q. Ilex*, *Q. Cerris*, and *Q. Suber*, the most promising, from an ornamental point of view, are *Q. Mirbeckii* and *Q. conferta*. The former is very rare in cultivation, and is not stocked by nurserymen. It has beautiful large foliage, persistent on the tree till January, and grows with great rapidity in the South of England, the specimen at Tortworth being very healthy, and 35 feet high by 3 feet 4 inches in girth. This oak is a native of Algeria, where it forms splendid forests, either in company with *Q. castaneaefolia*, or mixing with the cedars at high altitudes. Acorns can be procured from Messrs. Vilmorin, of Paris. *Quercus conferta*, the Hungarian oak, should be planted, as its foliage is very handsome. Other oaks seen at Tortworth were *Q. Macedonica*, 25 feet high; *Q. lobata*, 20 feet; *Q. glauca*, 15 feet; *Q. Aegilops*, 35 feet by 3 feet 1 inch; and *Q. Toza*, a good specimen. A curious variety of the common oak, with remarkably glossy leaves, quite entire or only slightly lobed in margin, is also growing at Tortworth, the tree being about fifty years old.

There is a fair number of maples in the collection, of which the most noteworthy are two trees of *Acer pictum*, about 40 feet high and 5 feet 6 inches and 4 feet 7 inches in girth, with short boles and wide-spreading branches. These are remarkable for the numerous suckers sent up by their roots. There is also a good specimen of *A. Volxemi*, a species from the Caucasus, with beautiful large foliage, and rapid in growth.

Two species of *Pterocarya*, a rare genus in cultivation, are represented—*P. Caucasia*, the Caucasian species, which has here produced fruit from which Mr. Elwes has raised a seedling; and *P. stenoptera*, from China, distinguished by the winged rachis of the leaf. The latter is 32 feet high by 2 feet 3 inches in girth, and was planted about twenty years ago. Though a tree of the plains of central China, where it grows along the banks of rivers, this species appears to be hardy in the South of England.

A specimen of the mountain ash of North America, *Pyrus Americana*, is about 20 feet high. *Pyrus Sorbus*, the true service tree, forty years planted, has attained a height of 40 feet and a girth of 6 feet. In Daniel's Wood there is a large *Pyrus*

torminalis,* our native species, which was 62 feet by 5 feet 1 inch in 1904. Lord Ducie also cultivates a peculiar form of the hybrid service tree, *Pyrus pinnatifida*, which he raised from seeds obtained in Norway.

There is a very fine specimen of the Californian *Castanopsis chrysophylla*, about 25 feet high, and laden with fruit. *Arbutus Menziesii*, from the Pacific coast, 35 feet high by 4 feet 4 inches in girth, appears to be happier at Tortworth than at Kew, where the foliage suffers much from spring frosts.

One of the most remarkable trees we saw is *Nothofagus obliqua*, one of the deciduous beeches of South America. This species was introduced by Lobb in 1849, but none of the original plants now survive. Seed was brought from Chile by Mr. Elwes in 1902, and plants were raised at Kew, which are growing there with great vigour. One of these, sent to Tortworth, is now 12 feet high, with a stout stem, having made phenomenal growth for a hardwood species. It bore the severe frost of May, 1905, without injury.

Of the many exotic birches which have been introduced, none of the American species have been very successful, though there are good-sized trees of *Betula nigra* at Kew. The Japanese species look more promising, and of these *B. Maximowiczii* is the most striking on account of its large leaves, and is represented at Tortworth by a thriving tree 30 feet in height and 1 foot 5 inches in girth. *Betula papyrifera, var. occidentalis*, which attains a large size in British Columbia, is now having a fair trial, as a considerable quantity of seed, collected by me in 1906, has been distributed to various places by Sir John Stirling Maxwell.

The American elm, *Ulmus Americana*, is represented at Tortworth by two young trees. This species is rare in cultivation in England, the only large tree that I have seen being at Syon. It is remarkable for its wide-spreading crown of foliage.

Ostrya carpinifolia, the hop hornbeam, is also rare in cultivation, yet it grows in youth at least as fast as the common hornbeam, and has attained at Tortworth 40 feet by 2 feet 7 inches. The two other species, *O. Japonica* and *O. Virginica*, also appear

* Figured in "Trees of Great Britain and Ireland," I., 153, plate 47.

to thrive well in England. A small tree of *Carpinus Japonica*, a hornbeam with very distinct foliage, has produced fruit at Tortworth.

In the collection there is a fine specimen of *Alnus cordata*, the Italian alder, 60 feet high by 6 feet in girth. This tree, which has very beautiful foliage and large fruit, is much less common than it might be, and succeeds well at Kew and Glasnevin. There is also a small tree of the rare American beech, *Fagus ferruginea*, which in New England suckers freely from the root, but differs little otherwise in appearance from the common beech.

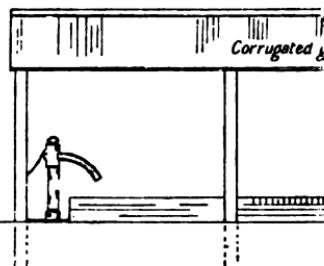
Aesculus indica, the Indian horse-chestnut, is cultivated at Tortworth, a few seedlings, raised from seed sent in 1890 by the late Duke of Bedford, doing well. This very handsome tree is exceedingly rare, the only large trees in the country being at Barton, in Suffolk. The Japanese horse-chestnut, *Aesculus turbinata*, of which Lord Ducie has young trees, is remarkable for the large size of the leaves.

The conifers at Tortworth are not so remarkable as the hardwood trees; still, there are some fine specimens. The Araucarias* are numerous and of considerable size, the best having been measured in 1904 as 53 feet by 7½ feet. *Picea Omorika*, the Servian spruce, is doing well, a tree 15 feet high having produced good seed in 1902. This species, which is quite at home on limestone, is remarkable for its very narrow pyramidal habit, and shows in many places more rapid growth than any other spruce, and may turn out to be of economic importance. There are two or three large trees of *Larix leptolepis*, one† of which measured, in 1904, 45 feet by 4 feet 7 inches, and was covered with cones.

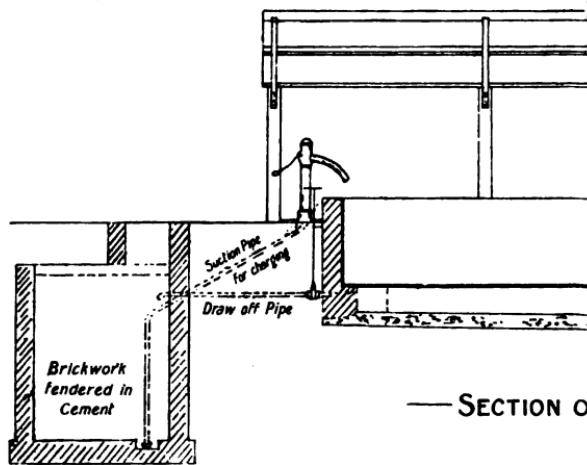
Of the silver-firs, the most remarkable at Tortworth are *Abies bracteata*, which is an extremely handsome tree, differing from all the other species in its peculiar buds, and *Abies firma*, which is rather rare in cultivation and seldom seen of considerable size. Here it is 55 feet high by 5 feet 9 inches in girth.

* The Araucarias at Tortworth are described by Lord Ducie in *Gardeners' Chronicle*, viii., 633 (1890). He also gives an account of the timber of one which was cut down in 1888.

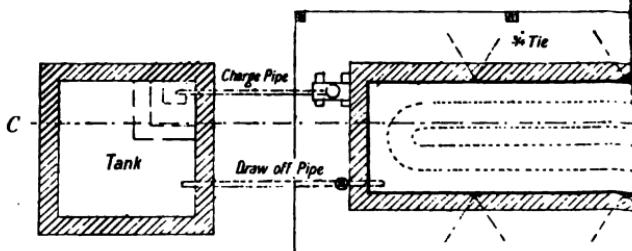
† Figured in "Trees of Great Britain and Ireland," II., 387, plate 108.



Sketch of Floating Thermometer



SECTION OF



PLAN

It appears to thrive as well as *Abies brachyphylla*, another Japanese species, and is very distinct in its broad coriaceous needles. It is very remarkable that we have not been able to find anywhere in cultivation the very distinct species, *Abies Mariessii*, which was introduced from Japan in 1879. It resembles *A. Veitchii* in the size and disposition of the leaves on the branchlets, but is easily distinguished by the rusty red colour of the densely tomentose shoots; and specimens of this rare species should be looked out for in collections, as possibly it may exist under a wrong name.

Mr. J. J. Harle, Lord Ducie's agent, conducted us through the woods, and our sincere thanks are due to him, and to Lord Ducie for his hospitality and kindness in allowing us to see these interesting trees.

AUGUSTINE HENRY.

ASHTON COURT.

Leaving Cheltenham at 8 a.m., in special carriages, Bristol was reached at 10 o'clock, where brakes were in readiness to convey the party to Ashton Court. The creosoting plant, which has been recently installed, at a cost of £154, was first visited. As creosoting is now becoming a necessity on most estates, much interest was taken in this, and the following particulars were supplied by Mr. Reid, forester, and Mr. Stone, clerk of works; while the accompanying plan has been kindly furnished by the courtesy of Mr. H. W. Napier, agent for the estate.

The method adopted in this country for creosoting is chiefly by what is known as the closed cylinder, or pressure system; but, while this can be profitably employed on extensive estates, on smaller estates the initial expense is too great. For such the following may be recommended as the cheapest and most effective plant we know.

On the Ashton Court estate the system used for creosoting is by absorption under heat, and is as follows:—A steel tank, 22 feet long, by 5 feet wide, and 4 feet high, made of mild steel of

an average thickness of about $\frac{3}{8}$ -inch. This tank is placed over a furnace built in brickwork, with a horizontal flue of about 40 feet in length, terminating in a chimney shaft at the furnace end. The furnace is suitably constructed to burn any rough lumber obtainable. The bark taken from the timber before creosoting, is used to maintain the fire, with the addition of small coal of a cheap kind. The tank is fitted with a 2-inch draw-off valve for emptying, having a 2-inch pipe drain to a built reservoir at a lower level, the advantage of which is stated below. The receiver is fitted with a $1\frac{1}{2}$ -inch suction pipe to a cast-iron jack pump for the purpose of re-filling the tank.

The process is very simple, and consists in placing the wood in the tank as desired, and fixing down by strainers. The creosote is then pumped from the receiver into the tank until the wood is quite covered. The fire is lighted, and the creosote brought to a temperature of about 220° F., and maintained at that heat for about 48 hours. The fire is then withdrawn, the valve opened, and, by gravitation, the oil runs away to the receiving tank. The heat of the furnace and tank quickly dries the surface of the wood, making it possible to remove it within an hour. Without this drawing arrangement it is a most difficult operation to take out the timber after creosoting. Fencing materials, gates, posts, cowhouse and farm outbuilding fittings, such as doors, external boarding, joists, studs, etc., are chiefly treated. In practice it is found that the absorption is not uniform, but depends on the quality and class of the timber. The degree of seasoning has an influence, and also the fact that the timber is fast-grown or the reverse, or close-grained. Mature Scots pine and beech readily absorb the creosote; spruce is not so absorbent. Dry larch varies as to the quantity absorbed. To creosote a larch field-gate, three-quarters of a gallon per foot cube is used, at a cost of about 1s. per gate. About 3,000 linear feet of railing is creosoted in this tank, at one cooking, at a cost of about one-eighth of a penny per foot. About 4 cwt. of cheap small coal is used per week, at a cost of 6d. per cwt.

In passing, we visited the Cider Institute at Long Ashton, where an orchard stocked with various kinds of apple trees for cider-making was shown, and where many ways of tree protection against stock were employed in order to test the

cheapest and most effective method. There is a nursery where the young apple trees are grown, which is also stocked with raspberries and black currants. These last were seen to be badly infested with *aphis*. Remark being made as to whether grass-covered land or bare soil was best adapted for an orchard, we were told that grass is best, as it keeps down growth, and, consequently, throws the trees into better bearing.*

We next proceeded to the estate nursery, which contains $1\frac{1}{2}$ acres, and has been recently formed. The exposure is due south, with steep rising ground on the north and east sides, sheltering it from the cold winds. Elevation about 250 feet above sea-level; the soil rests on carboniferous limestone. The shape is rectangular, 120 yards by 61 yards. The enclosing wire-fence is 6 feet high; stakes and straining posts are of creosoted timber. Eight wires are employed, the six lower being No. 6 plain galvanised, the two upper barbed. Stakes are erected the full height of the fence at 12 feet apart, for the

* Nothing is more striking in the results obtained at the Woburn Fruit Station than the prejudicial effects of grass on young trees. Apple trees planted at the same time, and under similar conditions, have been found to grow well or ill according to whether weeds have been kept down or the surface of the ground has been allowed to "grass over." In many parts of the country the same effects are equally striking, so much so, in fact, that one can readily tell by the appearance of the tops of the trees in an orchard (even when the surface of the ground is excluded from view by a hedge or wall) whether the soil is kept tilled or not. Not only is this true as regards fruit trees, but also in the case of many forest trees. Most hardwoods (the ash is a notable example) start to grow with great slowness when planted in grass, whereas they shoot ahead at a rapid rate if the soil is kept hoed. But much depends on soil and climate. The injurious effects of grass and weeds are much more conspicuous in East Anglia, with its stronger soils and low rainfall, than in the humid west, with its kindly loams.

What the cause may be is hard to say. Experiments at Woburn would appear to show that it is not a simple case of the grass and other plants depriving the trees of food and moisture. Possibly it is a case of the herbaceous plants excreting some substance that is poisonous to trees; perhaps it may prove to be the creation of conditions unfavourable to the life of the fungi that associate themselves with most tree-roots (*Mycorrhiza*). In any event the bad effects are not so conspicuous when the trees have had some years in which to establish themselves and to push their roots into the deeper layers of the soil.—W. S.

purpose of carrying the two top wires. Alternating with these, and thus bringing the whole to 6-feet centres, are shorter stakes, which reach only just above the six plain wires. Size of stakes, 7 feet 9 inches by 4 inches by 4 inches, and 6 feet by 4 inches by 4 inches; straining posts, 9 $\frac{1}{2}$ feet by 9 inches diameter; gate-posts, 9 feet by 10 inches by 10 inches and 9 feet by 8 inches by 8 inches. Including a 9-foot gate, with pales 5 feet 10 inches high, the cost of fencing materials was £16 14s. od. Labour erecting same (3d. per yard), £4 11s. od. Total cost of fence, £21 5s. od., or 1s. 2d. a yard for 362 yards.

The ground was trenched at a cost of £30, or at the rate of £20 per acre. Previous to being trenched the land had carried a crop of oats, and was in a very filthy condition with couch grass, so that the labour of cleaning considerably heightened the cost of trenching, which, in this neighbourhood, can generally be done for £16 per acre.

The total cost of forming the nursery was therefore :—

Cost of fencing materials, and fixing .	£21	5	0
Trenching and cleaning, 1 $\frac{1}{2}$ acres at			
£20 per acre		30	0
Total cost	£51	5	0

The system of cropping is a three years' rotation; thus only one third of the ground is under forest trees at one time. These are followed by a crop of roots, mangolds for preference, which are grown by the aid of artificial manures; using for the $\frac{1}{2}$ acre, 2 cwts. superphosphate, 1 cwt. sulphate of potash, and $\frac{3}{4}$ cwt. sulphate of ammonia, applied a month previous to sowing the mangold seed. A top dressing of $\frac{3}{4}$ cwt. of nitrate of soda, and 1 $\frac{1}{2}$ cwt. of common salt, is given early in July. The mangold tops are dug in as soon as the roots are cleared, and a dressing given of 1 cwt. best basic slag. Potatoes are planted the following spring, when 6 loads of farmyard manure are given. Mr. Reid is inclined to think that young plants make much better growth when plenty of organic matter is present in the soil, but gives no manure of any kind direct to the stock of forest trees. These comprise the following :—

Scots pine	.	.	2 years	1 year
European larch	.	.	1 year	1 year
Japanese larch	.	.	1 year	1 year
Beech	.	.	2 years	1 year
Elm	.	.	1 year	seedlings
Ash	.	.	1 year	1 year
Spruce	.	.	2 years	1 year

All excellent stuff, in the best of health and growth.

Here Mr. A. Henry uttered a note of warning regarding Japanese larch. Contrary to popular belief, he states that there are not two varieties of Japanese larch; and that in all his travels in Japan he had not seen a tree of this variety that had attained large dimensions, and he was very doubtful as to its value in this country as a profitable timber tree.

From this we proceeded to view the woods and plantations proper, which are situated on an undulating country of varied geological formation—chiefly carboniferous limestone and mill-stone grit—but marls, lower lias, and oolitic limestone also occur. The plantations for the most part occupy the slopes, the soil being in many places shallow, and they were in great part formed from 1860 to 1870; pure larch being chiefly employed, planted 4½ feet apart, and filled in with St. John's wort and privet to form game-cover. From this period (1870) the woods were given over to game-preserving entirely, and much harm was done where the privet was allowed to grow unchecked. During recent years this was to be seen struggling with the larch to a height of 30 feet, and many trees were killed and gaps formed; but where the privet had been cut back the ground is carrying a splendid crop of larch poles. Until recently these woods have not been properly tended, practically no thinning being done except where the estate men had cut out, haphazard, in the most convenient places, what poles were required; with the consequence that the crop is, here and there, very irregular.

Under the present *régime*, a thorough up-to-date system of management has been introduced, and the results are highly creditable to Mr. Napier, as well as to Mr. Reid.

These older plantations have been gently thinned and put

in order, and give promise of a fine future crop. In one of these, the other day, $\frac{1}{2}$ of an acre, not the best by a long way, had to be cleared, with a total result of 20 tons 14 cwts. of larch poles, sold at 18s. per ton, working out at £74 10s. per acre. This plantation is not more than 42 years of age.

Older plantations that have become unprofitable are being cut down and replanted as quickly as possible; while, in addition, about 10 acres of wasteland, or land let at less than 5s. per acre, is taken in hand and planted up every year.

The method now adopted in forming young plantations is to use a hardwood crop, at 6 feet apart, filling up to 3 feet with conifers as nurses. Both hardwoods and nurses are carefully selected, and the planting varied, so that each patch of ground is stocked with the trees most likely to succeed under the different conditions of soil, etc., that occur. At first only the ground for hardwoods was prepared for planting beforehand (besides any hard stoney patches), by means of loosening the ground with a "*holeing hack*" (described in Vol. 1. of the JOURNAL OF FORESTRY, page 63), the nurses being notched in; but so convinced has Mr. Reid become of the advantage and success of this operation, that the whole of the ground to be planted is now acted upon in this manner, the plants being afterwards inserted with the spade. The cost of thus preparing the holes varies from 1s. 3d. to 1s. 6d. per 100; and the cost of planting (4,840 trees) per acre, from 18s. to 23s. Naturally, the size of the plants used varies according to conditions, but the following are generally employed:—

Ash	2 to $2\frac{1}{2}$ feet.
Sycamore	2 to $2\frac{1}{2}$ feet.
Oak	2 to $2\frac{1}{2}$ feet.
Beech	15 to 20 inches.
Larch	15 to 20 inches.
Scots pine	9 to 12 inches.

The chief market for timber and pitwood is Bristol, which takes all kinds of rough hardwood timber, Scots pine, larch, etc., suitable for pitwood and tin-plate boxes, at so much per ton, according to quality, distance from market, etc. Generally prices run from 10s. to 14s. per ton. The following are the

usual prices for best quality of timber of the various kinds:—Oak 1s. 2d. to 1s. 6d.; ash, 1s. 4d. to 1s. 8d.; elm, beech, and sycamore, 9d. to 10d.; larch, 10d. to 1s.; Scots pine, 6d.; spruce, 6d. per cubic foot; hazel coppice of 15 years' growth makes from £2 to £3 per acre, while pole-wood of 20 years' growth, or more, from £4 to £6 per acre.

As on other estates, the woods here have their quota of diseases and pests. Of these may be noted:—

Fungi.—In places, noticeably where the ground is overcharged with moisture, the larch is badly attacked with blister (*Dasyscypha calycina*) and this has caused large gaps to occur. Here and there, in the newly-formed plantations, the honey-fungus (*Armillaria mellea*) has been found attacking larch and Scots pine, and also *Nectria ditissima* infecting young beech. Scots pine of about twenty years' growth have been attacked by pine needle-rust (*Hypoderma pinicola*).

Insects.—The pine-shoot moth (*Tortrix buoliana*) has been plentiful this year; in the recently planted woods hand-picking and killing had to be resorted to, and the trees have now formed fresh leaders. The ash-shoot tortrix (*Tinea curtisella*) has in places done a great amount of damage to young ash.

Animals.—Squirrels, in the early spring, do considerable damage to Scots pine plants, eating out the buds of leading shoots, and, in some instances, biting off the leader. Voles have, in the past, done much injury to young hardwoods, but last winter they were not so numerous, and very little damage has been done.

Almost adjoining the nursery is a plantation, one year old, situated on a steep bank on thin soil overlying the mountain limestone. Hardwoods are planted 6 feet apart. On the poorer ground at the top of the hill these consist entirely of beech. Further down, on better ground, ash are mixed with the beech. The whole is filled in to 3 feet with larch and Scots pine, most of them alternately. A few Japanese larch, Corsican pine, and *Catalpa speciosa* have been planted throughout for experimental purposes. The trees here seem in the best of health—a very promising plantation.

Ashton Hill Plantations. 130 acres. Carrying first crop, nearly pure larch, planted at 4½ feet apart. The portion on

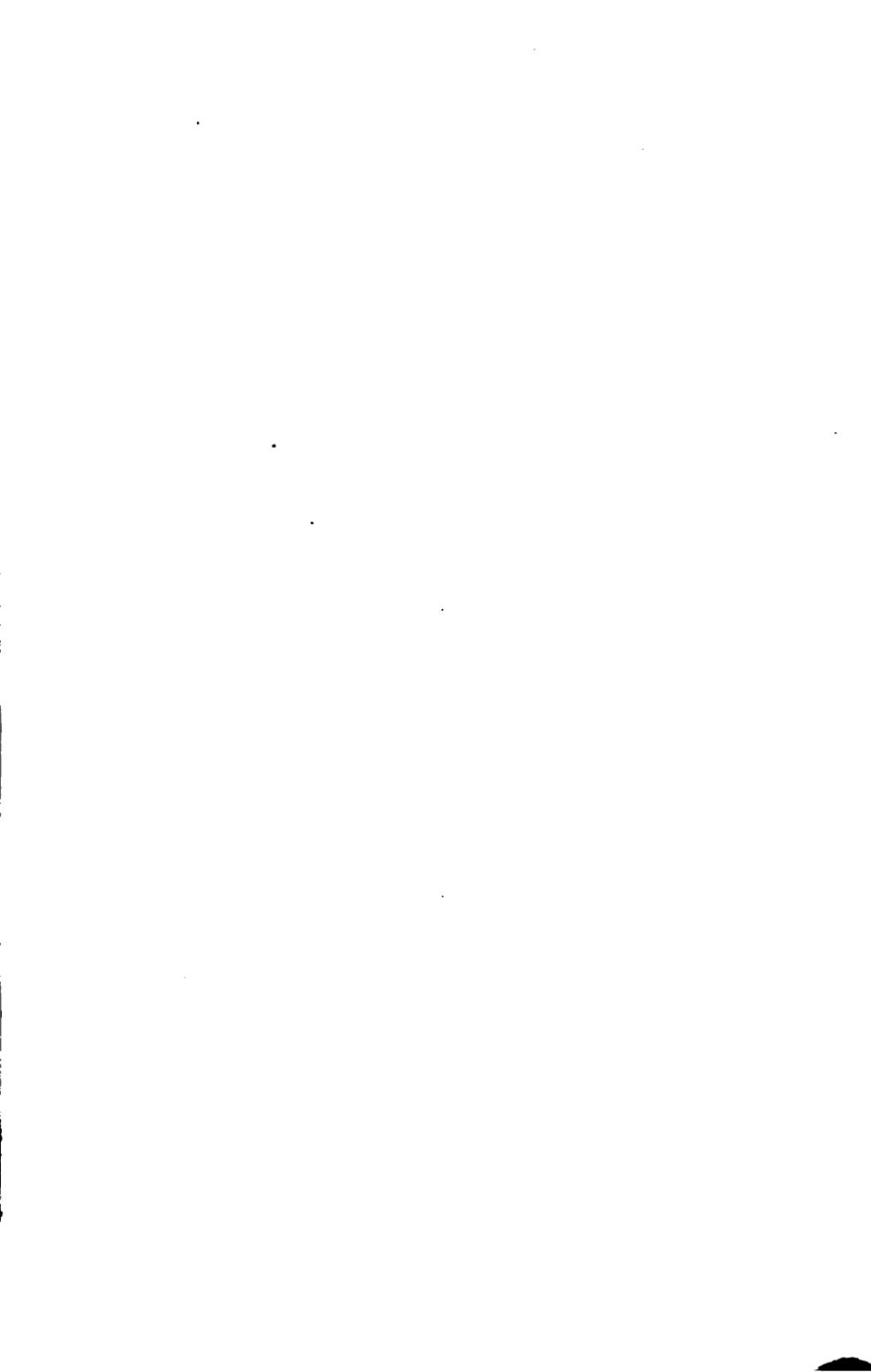
east side (50 acres) was planted in 1862; the remainder in 1867. Carries on the whole a very fair crop; clean, and from 40 to 45 feet in height. In a dingle some *Sequoia Wellingtonia* and *Cedrus Deodara* were planted in 1867, from seeds brought from California by the late Sir Greville Smyth. The sequoias are now about 63 feet high by 10½ inches quarter-girth; contents 48 cubic feet. The deodars are 60 feet high by 6½ inches quarter-girth; contents 17½ cubic feet.

These had been allowed room, and were branched to the ground. Almost at the top of the wood a sequoia was noticed that had been closegrown among the larch under true forest conditions, with the result that it was many feet higher than the surrounding larch, with a clean straight bole and very little taper.

A discussion having taken place regarding the particular fungus that had caused the death of one of the Wellingtonias, as well as a fungus that had killed some larch and Scots pine we had seen, it was remarked that it was exceedingly difficult to discriminate between the root-fungus *Fomes annosus* and the honey-fungus (*Armillaria mellea*), expert microscopic examination being necessary. Mr. Reid informs me that he has since sent specimens to the authorities at Kew, who state that the mycelium present on the bark of the Wellingtonia belongs to *Trametes radiciperda* (*Fomes annosus*), and that the fungus present on the roots of larch and Scots pine forwarded is *Armillaria mellea*.

Adjoining these plantations, 19 acres were enclosed and planted in the spring of 1905 from rough pasture land. Soil, shallow, resting on the carboniferous limestone. Altitude, between 400 and 500 feet. Hardwoods, chiefly beech, with a few ash and sycamore, used at 6 feet apart; larch and Scots fir used alternately to fill these up to 3 feet.

A heavy percentage of deaths occurred among the trees the first year, the cause being attributed to ants (*Lassius flavus*), which are here present in large numbers, owing to quantities of ant-eggs having formerly been used on this ground for pheasant feeding. Larch and beech suffered most. This year the ants have not been anything like so prevalent, due, possibly, to the wet season. Although doubt was expressed





SIXTY-ACRES PLANTATION, ASHTON COURT.

[*To face p. 67.*

by some members as to the cause, yet all dead plants pulled up were found to have the bark of the underground portion more or less eaten, and the general supposition was that this had been done by the ants. The plantation is this year making good growth, the trees averaging 3 feet in height, although the larch had suffered from the effects of a recent hail-storm, portions of the bark having been badly bruised, the sap exuding.

Sixty-Acres Plantation. 66 acres. Carrying a first crop, planted 4½ feet apart. The oldest portion, 31 acres in extent, was planted in 1862, and consists chiefly of larch, with a few birch and Austrian pines. One acre measured contained 414 trees, with an average height of 50 feet by 4½ inches quarter-girth; contents 2,900 cubic feet; 22 acres planted about 1870; the greater part of this is carrying a fair crop. Another acre measured contained 600 trees, averaging 45 feet high by 3½ inches quarter-girth; contents 2,250 cubic feet. A photograph of this wood is shown.

Entering the park, lunch was provided in the bungalow, erected shortly before the death of Sir Greville Smyth for the purpose of housing the splendid ornithological and other natural history specimens collected by him, and in which the visitors were greatly interested. After doing full justice to the hospitality so kindly provided for us, the health of Lady Smyth, her son, Mr. Greville Edwards, and the agent, Mr. H. W. Napier, were duly honoured and responded to. It may here be remarked that Mr. Napier, in the course of his speech, spoke in the highest terms of the forester, Mr. Reid; complimenting him by stating that he had been his right-hand man in carrying out the forestry work, in which his whole heart and interest were placed. Relations of this kind between agent and forester are very pleasant to see; but are, unfortunately, much too rare.

After lunch Pillgrove Plantation was visited. This is an enclosure of 16 acres, planted four years ago. The upper portion formerly consisted of standards of beech, sycamore, larch, and Scots pine, about eighty years old. Being situated in the park, it was deemed best, for the sake of amenity, not to clear the whole of the timber. It was, therefore, heavily thinned out and underplanted. The soil is shallow, resting on

he mountain limestone, exposure sloping towards the south. Elevation about 400 feet. Hardwoods used were beech, sycamore, Norway maple, and ash, filled in with larch and Scots pine in equal proportions. These have all made magnificent growth. The ash, sycamore and Norway maple average 8 feet in height; beech 7 feet; larch and Scots pine 6 feet. The ash were attacked the year after planting by the *Tortrix curtisella*, and as a remedy were cut back to the ground the following spring, with the result that they are now quite as tall as the other hardwoods. Here, too, *Nectria ditissima* was noticed on a few of the young beech, but these, from their vigour, seem to be outgrowing the attack. The southern end of this plantation formerly consisted of oak standards about ninety years old. The worst of these were felled in 1902, and the ground, a nice sheltered valley with fairly deep soil, planted up the following spring with larch and Douglas fir. The latter, being expected to grow the faster, were intended for the final crop. Now, however, the larch are 7 feet high, and so far doing well, while the Douglas fir, probably from the presence of lime in the soil, are not thriving, and are only from 3 to 4 feet high. As the ground is too heavily shaded for larch, and the Douglas fir do not look like making a crop, it is proposed to thin out the larch and underplant with beech.

Opposite the last-named plantation a bank containing some fine timber was seen, larch especially showing great size and length of bole.

It was intended that we should visit a few more of the plantations, but time did not permit.

Passing on through the magnificent park, the three varieties of deer which it contains were duly admired.

Several clumps of plantations here which formerly consisted of timber at maturity, have been heavily thinned out, leaving the outer margin entire, and underplanted, keeping the ornamental as well as the economic side of forestry in view. From what we saw, it is evident both have received due consideration.

The park contains some very fine old trees, notably the reputed Domesday oak, and another oak near Sand Barrels. A splendid beech in a small clump near the icehouse was the

subject of much admiration. This has a clean bole of 50 feet, where it divides into two huge limbs. The total height was estimated at 120 feet. The girth was measured by Mr. Elwes at 5 feet from the ground, and was found to be 15 feet 8 inches over bark. This monster beech was estimated, by competent men present, to contain about 600 feet of timber. There are also some very large elms, several of which contain even a greater cubic measurement than the beech referred to; but, unfortunately, the greater number are past maturity, and more or less disfigured by having their tops and branches broken off by high winds.

Rain, which had been falling most of the afternoon, now came on heavily, so that, after a hurried look through the well-kept gardens, and a walk past the magnificent hall, three hearty cheers were given for Lady Smith, and her agent, Mr. Napier, brakes were entered to convey us to Bristol station, and one of the most educational and instructive meetings the Society has ever held was at an end.

The following woods at Ashton Court, though on the day's programme, were not visited:—

BIRCH WOOD.

(14 ACRES.)

This wood consisted of oak standards-with-coppice, and was felled in the spring of 1903, the ground cleaned and holed in the autumn, and planted in December, 1903, with a mixture of oak, ash, beech, larch, and Scots pine. The average heights of the plants now are: oak, 5 feet; ash, 5 feet; beech, 5 feet; Scots fir, 5 feet; larch, 5 to 6 feet. The oak did not seem to start growing the first two years, and so were cut back to the ground level; since then their growth has been truly marvellous, as will be noticed from the heights given. Some of the ash were treated similarly, and have done equally well. The soil is shallow in places, resting on the dolomitic conglomerate, situation sloping north; elevation about 300 feet. This, in my opinion, is the best young plantation for its age I have seen; the Scots pine and beech on the shallow places are growing splendidly. The average heights given

are rather under than over ; and the size of plants used similar to the aforementioned lots.

LIME RIDGE WOOD.

(16 ACRES.)

About 5 acres of this was coppice-with-standards, which was felled and cleared in the spring of 1904. Seven acres was larch planted eighteen years ago, and had to be cut, as it was completely ruined by squirrels barking the leaders of the young trees. The remaining 4 acres was rough waste ground carrying no crop. Where the underwood and standards were grown the plants have done much better, no doubt owing to their roots feeding on the decayed vegetable matter from the leaves. The whole enclosure was planted in the spring of 1905 with oak, ash, beech, sycamore, larch, and Scots pine. The situation slopes south and is very hot, especially where the soil is shallow. The elevation is about 300 feet, soil resting on the carboniferous limestone. The average height of larch, $4\frac{1}{2}$ feet ; Scots pine, $3\frac{1}{2}$ feet ; ash, $3\frac{1}{2}$ feet ; beech, 3 to 4 feet ; sycamore, 4 feet ; oak, $3\frac{1}{2}$ feet. That is on the portion where the standards and coppice were grown ; where the young larch were they are rather less, and on the rough waste piece they are still smaller.

In compiling the foregoing I have had the assistance of notes supplied by Mr. R. G. Forbes, Tavistock, and Mr. H. Reid, Ashton Court. The notes supplied by the Ashton Court Estate, when we visited there, have also been used.

J. P. ROBERTSON.

THE TUBNEY ARBORETUM.

SECOND ANNUAL REPORT, 1906-1907.

THE Committee, consisting of Messrs. G. E. Baker, H. J. Elwes, F.R.S., W. R. Fisher, A. D. Godley, G. Marshall, and Professor S. H. Vines, D.Sc., F.R.S., met at Magdalen College on the 16th November, 1906.

Before the meeting Mr. Elwes and Mr. Marshall visited the

Arboretum, the management of which had been carried on by Mr. Baker and Mr. Fisher. The Committee approved of the measures that had been taken. Mr. Baker was appointed Chairman, and undertook to keep the minutes, and Mr. Fisher was requested to superintend the work. It was pointed out that all the cost of the undertaking now falls on the College, and hopes were expressed that the Royal Agricultural Society would make some contribution to the initial cost and an annual grant towards its maintenance.

1. *Planting Operations.*

Planting was commenced at about the middle of November, and most of the plants in the Nursery that had been originally raised from seed in Devonshire by the late Hon. Mark Rolle were planted in the Arboretum. A few of these plants are, however, too small to leave the Nursery, while a few others of a purely ornamental character were planted in the Tubney Rectory garden. Besides the above, a number of plants, chiefly broadleaved, presented by Mr. Elwes and Sir Hugh Beevor, have been planted, as well as specimens of *Pinus divaricata (Banksiana)*, *Larix Kurilensis*, and *Tsuga Mertensiana*, presented by the Rev. H. J. Bidder, Professor Somerville, and Messrs. Herd & Co., Penrith.

The Arboretum now contains 1,012 plants of 148 species and varieties of conifers and 344 plants of 48 species and varieties of broadleaved trees, being in all 1,356 plants and 191 species. This is in addition to the beech planted round each planted group, that are intended to shelter and draw up the plants. The groups of plants are separated from one another by the standard oaks and the clumps of coppice and sycamore saplings, that were on the area before it was enclosed.

The planting has been most successful, the plants show no falling off in growth, but are quite established in their new home. The wet season and the shelter from wind and frost afforded by the trees and underwood in the area, as well as by the dense mass of bracken outside it, are largely responsible for this success. The bracken in the Arboretum was cut before the planting and the new shoots were beaten down last June,

while, in consequence of the heavy acorn crop last year, the ground inside the fence is densely stocked with oak seedlings. Very few seedlings occur outside the Arboretum, in the unfenced area covered with bracken, where there are plenty of rabbits.

The only failure to report is that the sole representative of *Larix Griffithii* died, and that the plants of *Picea Morinda* and *Abies Nordmanniana* have been injured by frost and aphides, *A. grandis* escaping the latter. Even *Pinus palustris*, a semi-tropical pine, has escaped injury from frost, and looks remarkably healthy. The silver-firs are being sprayed to keep-off the aphis.

In order to secure forest conditions and draw up the plants as well as to enrich the soil with beech humus, beech has been planted round all the smaller groups of plants, the number of plants in each group ranging from one to thirty-six, according to the number of each species that was available.

A book has been prepared with a list of all the plants, and with a column for future remarks on their growth.

2. Future Requirements of the Arboretum.

There is still room for a few more plants in the Arboretum, especially if some of the purely ornamental varieties of *Cupressus* and *Thuya* be removed, as they are clearly unsuited for the Arboretum, where they have been planted temporarily for shelter.

The chief requirements as regards conifers are *Picea Sitchensis*, *Abies pectinata*, *A. lasiocarpa*, *A. nobilis*, *A. cephalonica*, *Larix occidentalis*, *Chamæcypris Nootkatensis*, *Juniperus Virginiana*, *Taxus baccata*, *Sequoia sempervirens*, *Podocarpus*, *Dacrydium*, *Torreya*.

The broadleaved collection is fairly representative, thanks to Mr. Elwes, of plants that will grow in this locality, but sweet-chestnut, *Sorbus domestica*, and *Carpinus Betulus* should be added.

The plants are all labelled, but the spruce laths painted white, on which the names are written with a woodman's indelible pencil, will not last more than three or four years, and a more durable substitute must eventually be provided. Split

laths of sweet-chestnut would probably be the best for the purpose.

3. Nursery.

An excellent well has been dug and a raised zinc cistern and pump provided, so that every facility for watering seed-beds is now available. The 40,000 yearling larch plants brought from the Englefield Green Nursery were large enough to be planted out when only two years old, and have been planted in adjoining College waste land.

In their place the following have been lined out: Yearling Douglas fir; 1,000 *Thuya plicata*; 1,000 *Tsuga Mertensiana*; beech; sessile oak from Norway; *Prunus serotina*.

There are of last year's sowings about 25,000 Douglas fir and 50,000 Corsican pine two-year seedlings. These will be at once dug up and sold. There are also about a hundred plants of *Picea Omorica* and a few species of *Abies*, also of *Pinus leucodermis*, still too small to be removed from the Nursery.

Seed of the following species was sown last spring, the seed having been purchased from Mr. Rafn, of Copenhagen:—Larch, 9 lbs.; Corsican pine, 4½ lbs.; Scots pine, 2½ lbs.; Douglas fir, 2½ lbs. Also a few seeds of the following:—Pyrenean pine, *Ginkgo biloba*, *Abies nobilis*, *Libocedrus decurrens*, *Pinus excelsa*, *P. Gerardiana*, *Cedrus Deodara*, *Sophora Japonica*.

The Himalayan seeds were kindly given by Mr. A. Smythies, of Dolton, Devonshire, and the plants of *Thuya* and *Tsuga* by Mr. Fotheringham, of Murthley Castle, Perthshire.

The seeds sown this spring have germinated satisfactorily, and most of the plants look well, except those of *Ginkgo*.

At the same time there is a great unevenness in the plants in the lower part of the Nursery, and it is proposed, as soon as this part has been cleared of the two-year seedlings which are to be sold, that the land should be manured with farmyard manure, and a crop of potatoes reared. This will give a good bottom soil for the plants' roots. The seed-beds this year also had no leaf-mould on the surface to cover the seeds, and in future supplies of leaf-mould must be secured every spring.

Besides the seeds sown in the Nursery, some *Eucalyptus* seed was given by Mr. Eales, Commissioner of Pegu. This

Professor Vines undertook to sow at the Botanic Garden, and Mr. Baker, the head gardener, has raised from this seed some very fine plants, which have been planted in the Arboretum.

The nurseryman, William Bull, has shown great care in the planting and nursery work.

Concluding Remarks.

The College has generously paid all the expenses connected with the Arboretum and Nursery, and the total cost up to date since 1904 is as follows :—

	£	s.	d.
By Royal English Arboricultural Society.	17	3	9
„ Magdalen College	...	...	60
Total	...	...	<u>£77</u> <u>3</u> <u>9</u>

It is to be hoped that the proposed sale of plants from the Nursery will go far to repay most of this expenditure.

At the meeting of the Council of the Royal English Arboricultural Society at Lincoln on the 5th November, 1907, Mr. G. Cooper, of Gateshead, was appointed an additional member of the Arboretum Committee.

A meeting of the Arboretum Committee was held on the 17th November, 1907, at Magdalen College, after an inspection by Messrs. Elwes, Marshall, and Fisher. Mr. Baker and Mr. Godley also attended. Mr. Cooper and Professor Vines were unable to be present. The above report was accepted, and it was decided that the present names of some of the plants should be revised during the ensuing year.

W. R. FISHER.

17th November, 1907.

Reviews and Notices of Books.

WORKING-PLAN OF THE ARDROSS WOODS.

AN admirably succinct working-plan for the Ardross Woods, in Scotland, the property of Mr. C. W. D. Perrins, of Ardross, has just been prepared by Professor Schlich, assisted by Mr. R. S. Pearson, of the Indian Forest Service, and has been published by Bradbury, Agnew & Co.

Setting aside 336 acres of Policy Woods, the plan deals with 4,088 acres in the basin of the Alness river and its tributary, the Blackwater. Three thousand eight hundred and nineteen acres of these woods are divided into three quality classes, rising in inverse order of value from the valley upwards, while above the 1,000 feet level the remainder is classed as unproductive. The first quality is woodland, producing 50 cubic feet and upwards per acre mean annual increment, the second from 30 to 50 cubic feet, and the third less than 30 cubic feet.

The greatest difficulty in dealing with these woods is that the age-classes now on the ground are so unsuitable. Thus, the areas carrying trees of from 1 to 20, 20 to 40, 40 to 60, and over 60 years old are, respectively, 6, 4, 87 and 3 per cent., or, while 10 per cent. is less than 40 years, 90 per cent. is over this age. The author of the plan, therefore, instead of prescribing the felling annually of the total number of acres divided by the number of years of the rotation, which would normally have been 48 acres, takes a middle course and lays down for the first 20 years that 67 acres per annum shall be felled, so that at the end of this period the woods under 40 years of age will occupy 41 per cent. of the total area, and those over 40 years will represent 59 per cent. This is the first step towards a proper gradation of age-classes, and hereafter a new allocation, going farther, can be made.

The rotation is fixed at 80 years, but the plan does not go into the question or show the reason for fixing upon this age; it is merely stated to be the age which with woods of this kind

76 Working-plan of the Ardross Woods.

experience shows to be the right one. No doubt the great knowledge and weight of the author is sufficient for an *ipse dixit* of this kind, but we venture to think that it would have been well to explain at a little greater length, lest in after years the owner of these forests should ask why the figure 80 was adopted, and finding no reason assigned, should change it on unsound grounds.

It would also be interesting to know if the rotation is based on the requirements of the Scots pine, which at present forms the greater part of the crop, or of the larch, which is eventually to form half the crop, and which is the most valuable species.

Besides Scots pine and larch the crop contains spruce, and it is intended to retain these species, experimenting at the same time with Douglas fir, hemlock spruce, *Thuya plicata*, *Abies grandis*, and others, in good and sheltered localities. There is even a 21 acre experimental area, which seems a very good idea. The larch is to be brought up to the proportion of half the crop in the better localities, mixed with pine or spruce, while the higher and drier parts are to be of Scots pine and the moister of Norway or Sitka spruce, which latter is fast-growing. The proportion of larch cannot be increased, because it cannot be grown pure with safety. It is either to be planted in alternate lines with the pine or spruce, forming straight away half the crop, or in every third line, the other species being so thinned that at the end of the rotation the larch will form half the crop. As the larch suffers so much from blister, the latter method sounds the safer. The author does not propose the cessation, because of this disease, of larch planting, but hopes to produce vigorous trees and so overcome the enemy by growing larch in suitable places only. Considering the great value of the species this decision sounds wise. Perhaps the Japanese larch, less liable to the disease than the commoner kind, may be found, in the experimental area, to thrive, and if so will be introduced, to replace the latter partly, though the plan does not mention this. Its different habit would somewhat alter the silvicultural conditions. Much, too, can be done in the thinnings to remove danger, not only in the case of the larch, but also of the Scotch pine, which suffers here from *Peridermium pini*. It is, in fact, by

thinning, impossible to extirpate fungi completely, since the evil cannot always be at once detected, but, as in so many other dangers to forest growth, the keeping of a crop in a really vigorous condition is the best panacea.

We find no prescription for dealing with crops under twenty years of age, but it may be, that in such, if ever, the fungus could be kept off by thinning, and it appears not impossible that if a crop of larch survives uninfected to a certain age it may go on safely thereafter. At any rate, the author of this note has heard of neighbouring and similarly situated larch-woods, the one young and the other relatively old, of which, while the former became badly infected, the latter completely escaped.

We are tempted to think that it would be safe to go forward a little more boldly than the plan seems to recommend in the planting of Pacific Douglas fir, of course only in good soil and sheltered spots, for there is now a considerable body of evidence in favour of this species. If the Douglas fir succeeds it does so thoroughly defeat its neighbours, *vide* Prince Bismarck's two side-by-side plots of common spruce and Douglas, where in thirty years the latter produced wood twice in quantity and three times in value that of the former. Note also how the Prussian Government has lately officially ordered the extended use of the Douglas. Too much stress may be laid on exotics, but it often happens that a plant is only accidentally, not indigenous, in a country. The *Rhenoster* bush is not indigenous in South Africa, but its seed having been imported accidentally in the packing of gin-cases, it has now spread with unparalleled vigour. This plant would certainly have been indigenous if it had had a chance. So with Douglas fir, there was no way formerly for its becoming indigenous in Europe, but its vigorous growth here seems to show that, barring accident, it might have been an indigenous plant of the old world. Had it been geographically possible for the tree to reach us we might indeed pause and ask ourselves why, if it could have come here naturally, it in fact has not.

One singular and ingenious arrangement, to prevent the too great exposure of the soil over large patches of country, has been adopted in the felling prescriptions. This is to take four

78 Working-plan of the Ardross Woods.

or five blocks (those which alone are to be felled during the first twenty years), and fell first in one block, next in another block, then in a third block, and so on, not returning to the neighbourhood of coupe 1 till four or five years later, when by that time the new crop should be well forward.

The working-plan proposes clear felling and artificial reproduction only, but might not natural regeneration have been allowed to help at least to some extent? The coupes are large, so that natural regeneration from the neighbouring standing trees would not be everywhere possible, and seed-bearers would have to be left scattered about. If this were doubtful or useless for the larch surely it would be easy with the pine, more especially if the soil were scratched up a little in good seed-years. The predominance of the pine could be prevented artificially without any difficulty.

Over the remainder of the forests thinnings are to be continued. Fortunately thinnings of diseased trees have, in the past, been carried on; otherwise the crop would be in a worse condition, so far as disease is concerned, than it is.

We regret having to point out some apparent errors in the estimates given on page 25 of the working-plan. Pit-planting cannot possibly be done at 2s. 6d. per 1,000 plants, and notching an acre with 3,800 three-years-old plants must cost considerably more than 6s. Draining should cost only 1s. 6d. a chain, and not 2s. 6d., as stated.

The plan contains a clear description of the dangers to be feared, definite directions about the nursery, and cautious estimates. Even so a very handsome profit is anticipated, and we are perfectly sure that if the author's rules are strictly and closely adhered to the forest will vastly improve.

The Appendices are No. I., A Table of quality classes; No. II., A Table of age-classes; No. III., A detailed description of Blocks; No. IV., A sample Control Form; and No. V., A Map (and there are also large-scale maps, not, of course, with the plan). The information in Nos. I. and II. is to be found in No. III., and thus might perhaps have been omitted; the map is very handy, and the Control Form, while quite simple and short, contains everything that is necessary.

Current Topics and Short Notes.

WE have to acknowledge receipt of the following books and other publications from their authors :—

Webster's Foresters' Diary and Pocket Book, 1908, which contains much new and useful information and is indispensable for practical foresters. Rider & Son, Aldersgate Street, London.

Matthey's "Exploitation Commerciale des Bois," Vol. II. Paris, Lucien Laveur, 1907.

"Trees and their Life-histories," by P. Groom, M.A. Cantab et Oxon, D.Sc., Oxford. A splendidly illustrated book, showing all our trees and shrubs in different stages of growth. This is published by Cassell & Co., London, 1907.

"La Forêt de Lyons, in Normandy," by L. de la Bunodière, Marquis d'Esmalleville, giving an account of that fine forest of beech, hornbeam and oak. Vve. Crochet, Lyons-la-forêt, 1907.

"Report on Injurious Insects and Other Animals." Walter E. Collinge, M.Sc. Cornish Bros., Birmingham, 2s. 6d.

"Quarterly Notes on Belfast Museum," by Arthur Deane, Curator, 1906—7.

Publications of U.S. Department of Agriculture.

"Forest Planting in the Platte River-Valleys." F. G. Miller.

"Prolonging the Life of Mine Timbers." J. M. Nelson.

"Second Progress Report on the Strength of Timber." W. K. Hart.

"National Forests and Timber Supply." T. H. Sherrard.

"Progress of Forestry in 1906." R. Craft.

Also a number of leaflets by G. Pinchot, the chief of the Forestry Branch, on the "Western Larch," "Lawson's Cypress," "Cham. Nootkatensis," "Abies nobilis," "A. concolor," "A. grandis," "A. magnifica," "A. lasiocarpa," "Pinus monticola," "Picea Engelmanni," "P. Sitchensis," "Pseudotsuga macrocarpa," and "Eucalypts."

The Indian Forester, August, September, and October.

We regret that there is no space to give full notices of these books and pamphlets in our present number.

Honours to Members of the R.E.A.S.—On the occasion of the King's birthday, Mr. J. F. F. Horner, Commissioner of Woods and Forests, was made a Knight of the Royal Victorian Order.

Mr. Alderman Gillies has been re-elected Mayor of Gateshead for a second year of office.

Forestry Education.—Mr. N. W. Jolly, B.A., Balliol College, has obtained the Forestry Diploma of the University of Oxford, and has been appointed to the Indian Forest Department, in Burmah. He was a Rhodes scholar from Adelaide, Australia.

The Burdett-Coutts Geological scholarship £120 a year, for two years, has been gained by Mr. R. L. Robinson, B.A., Magdalen College, also a Rhodes scholar from Adelaide. He is now engaged in geological research, and is completing his practical forestry course for the diploma.

Railway-rates.—A Committee has been appointed by the President of the Board of Trade, to inquire into railway-rates and other matters connected with British railways. It is to be hoped that the committee will be cognisant of the great discouragement that results to planting trees, owing to the present unfairness of the rates for carrying timber by rail. Sir Hugh Beevor may be relied on to bring this matter to their notice.

SALES OF TIMBER.

The following circular was sent out by the Publication Committee of this "Journal," and has already borne fruit, in the reports given below. All available information should be sent to Mr. J. P. Robertson, Edensor, Bakewell, Derbyshire :—

"The Publication Committee of the JOURNAL OF FORESTRY are most desirous that a list of current prices of timber should appear regularly in the JOURNAL, as being an object in the interest of nearly every member of the Society.

"As it is necessary that this information, in order to be of general utility, should come from all over the country, it is hoped that the local secretaries will contribute toward this end, as to the prices in their own particular neighbourhood.

"We are anxious that the information so given should be thoroughly reliable, and prices should, as far as possible, be quoted at per cubic foot, and all measurements should be genuine and authentic. Notes to be included: as to how measured; if the limbs are included, or boles only; allowance for bark, if any; quality, where situated, and the distance from nearest railway station."

Ireland.—It was generally supposed that when the trees blown down in the great storm of February, 1903, were cleared away that there would be little timber offered for sale for some years to come. A large number of English and Scotch timber merchants opened up business in Ireland tempted by the low prices and good quality of the storm-felled trees. The last of these are now cleared, but contrary to expectations the output seems to increase rather than diminish. There are now certainly twice as many timber-merchants buying in Ireland as there were ten years ago, and all of them appear to have as much timber offered to them as they can handle. As they, almost without exception, ship all classes of wood except large Scots pine and spruce in the round to England, there to be re-sold, the limit of their output is bounded only by the capital they can find for working expenses. Numbers of these merchants have from 25,000 to 50,000 tons on hand at the present moment, but it is impossible to believe that this output can be maintained for more than a very few years. The cause of this exceptional cutting is the transfer of the land upon which woods and plantations stand to the purchasing tenants of the neighbourhood, and the result is unfortunately the wholesale clearance of all outlying groves and woods as well as of hedgerow trees.

In spite of the largely increased number of buyers, so much timber is being offered, that the price though of course recovered from the storm glut of 1903—4, has not advanced as far as it ought. A quantity of this output is from estates, the sale of which is delayed only by the clearing of the woods. These are therefore forced on the market for what they can be sold, by owners who are ignorant of their value, to merchants who are indifferent owing to the quantity of wood offered them whether

they buy or not. As may be supposed, the result is a very serious loss to the producer, and the generally resultant feeling that planting does not offer very attractive means of investing money.

AVERAGE PRICES OF IRISH TIMBER FOR 1907.

Calculated at "delivered in Dublin." Hopper's measurement—tape over bark.

Kind of Tree.	Price per cubic foot.	Kind of Tree.	Price per cubic foot.
	s. d. s. d.		s. d. s. d.
ASH.		SYCAMORE.	
Good quality, butts only ...	1 0 to 1 4	Butts over 20 ins.	1 6
Rough butts and big arms ...	0 8 " 1 0	" under "	0 6 to 1 0
Tops to 6in. diam.	0 6	Bobbin wood ...	0 5
OAK.		ELM.	
Large clean butts, 16 ins. quarter girth and over ...	1 2 to 1 4	Heavy butts ...	0 7 to 0 10
Smaller girthed butts, 12 ins. to 16 ins. quarter girth ...	0 8 " 1 2	Light butts and tops ...	0 4 .. 0 6
Below 12 ins. quarter girth, almost unsaleable.		LARCH.	
BEECH.		To 6 ins. diam. ...	0 8 to 0 11
Butts over 20 ins.	1 0	PIT WOOD.	
" 14 ins. to 20 ins.	0 9	Light Scots or Spruce ...	0 4
Below this size ...	0 6 to 0 8	HEAVY SCOTS, SPRUCE, and SILVER	
Tops to 6 ins. diam.	0 5	fetch about the same price, and unless there is a local sawmill, must be in lots of 1,000 trees or over to induce the buyer to put up a mill; in such lots they would fetch 2½d. to 4d. standing, or say 6d. to 7½d. in Dublin.	

The above represent the prices to which timber-merchants are prepared to go; but buying as they do in bulk, they frequently give only a fraction of the above prices.

It is quite the exception to find timber in Ireland sold by measurement. The rule is either to sell in bulk ("all trees marked" or "the wood as standing" viz., a clean-cut) or by the ton.

The prices I give above are reduced to the average of those

generally obtainable in the country, plus felling, carting and rail expenses to Dublin.

That is the price delivered in Dublin or at other principal seaports on the East Coast.

PORTUMNA, November, 1907.

A. E. MOERAN.

The Eastern Counties.—A large proportion of the timber in this district is disposed of by private treaty, although here and there public auction sales take place. Wherever possible the merchant carts direct to his sawmill, thus saving railway carriage, but in long distances from the consuming centre the timber is conveyed by rail. The distance varies a great deal between woods and station; in some cases only 3 miles of hauling is necessary, whilst in others 7 or 8 miles. If the distance is put at 5 miles average this would give a fair example of the haulage between woods and station.

The general system of measuring is with tape, both for quarter-girth and for length. The butts are measured separately from the arms and in the same way, but their value is smaller.

The general allowance made for bark is 10 per cent.

	Per cubic ft.—s. d.		Per cubic ft.—s. d.
Oak, prime butts	... ... 2 0	Sycamore	... ... 1 6
.. medium ..	... ... 1 6	Birch	... ... 0 8
.. small ..	... ... 1 2	Alder	... ... 0 6
.. arms, large ..	... ... 1 0	Larch	... ... 0 10
Ash ditto.		Scots Pine	... ... 0 5
Beech ...	... ... 1 0	Spruce	... ... 0 5
.. arms ..	... ... 0 8	Poplar	... ... 0 8
.. .. small ..	... ... 0 6	Chestnut, Horse	... ... 1 0
Elm butts, <i>suberosa</i>	... ... 1 0	Spanish	... ... 0 10
.. .. <i>campestris</i>	... ... 0 10	Willow, first quality	... ... 5 0
.. .. wych ..	... ... 0 8	Silver-Fir	... ... 0 5
.. arms ..	... ... 0 6	Lime	... ... 0 10

C. HANKINS.

WORDWELL,

BURY ST. EDMUNDS.

Woburn and District.—By giving particulars of some of the sales of timber on this estate during this year an opinion can be formed as to the size and quality as well as the prices obtained for the different lots sold.

Sales of Timber.

Lots.	Cubic Feet.	Aver- age.	Per Cubic Foot.	Sale Price per Lot.	Remarks.
SALE No. 1.			s. d.	£ s. d.	
10 Ash ...	225	22	1 8 <i>1</i>	275 0 0	
166 Oak ...	2,975	18	1 8 <i>1</i>		Mostly grown from stools; Ash, black-hearted.
SALE No. 2.					
186 Scots Pine ...	2,230	12	0 7	105 0 0	Small, but good quality.
12 Oak ...	400	34	2 0		1st class timber.
SALE No. 3.					
200 Larch ...	1,200 1,800	15	1 0 0 9	127 10 0	Stood too long; 15 per cent. bad timber.
SALE No. 4.					
2 Beech ...	160	80	1 0		Rough timber.
4 S. Chestnut ...	54	13	0 6		Badly cupped.
174 Oak ...	3,786	21	1 8 <i>1</i>	352 10 0	Only 2nd class timber.
12 Scots Pine ...	510	42	0 8 <i>1</i>		Beautiful trees.
SALE No. 5.					
23 Oak ...	970	42	2 0		
13 Ash ...	300	23	2 6		
," Tops ...	30	—	1 0	145 0 0	
1 Beech ...	40	40	1 0		
3 Elm ...	135	45	0 9		
SALE No. 6.					
100 Oak ...	1,060	10	1 0 <i>1</i>		
115 S. Chestnut ...	2,690	23	0 10		Very moderate lot of timber, growing on sandy land, amongst larch, spruce, &c. See lot 7.
2 Ash ...	20	10	1 6		
13 Sycamore ...	160	12	0 6		
4 Beech ...	100	25	1 0		
SALE No. 7.					
790 Larch ...	13,510	17	0 9 <i>1</i>		
1 Scots Pine ...	5	5	0 6		
6 Spruce ...	290	48	0 6		
1 H. Pine ...	126	126	0 6	558 15 0	
3 Silver Fir ...	54	18	0 6		
1 W. Pine ...	15	15	0 6		
SALE No. 8.					
122 Oak ...	5,710	50	2 0		
," Tops ...	480	—	1 6		
25 Ash ...	720	33	2 6		
," Tops ...	100	—	1 0		
18 S. Chestnut ...	633	35	1 0	743 3 0	
7 Hornbeam ...	130	18	1 0		
1 Elm ...	64	64	0 9		
1 Cherry ...	15	15	1 0		
SALE No. 9.					
49 Beech ...	2,205	45	1 0 <i>1</i>		
4 Ash ...	155	39	3 1		
32 Oak ...	1,170	40	2 3	372 5 0	
134 Larch ...	1,710	13	1 1 <i>1</i>		
2 Elm ...	85	42	0 10		

NOTE.—The average cubic feet per tree, and the price per cubic foot, are given approximately only, but are near enough for the purpose. The total sum for each lot is correct.

All the lots are coppice-grown. I have given no hedgerow grown timber (we fell very little) or small parcels, of which there are a good many in the year, and for which we can get a good price locally.

All the sales were by private treaty with the exception of No. 9. This lot was sold by public auction on the Chenies estate, in Bucks, where we have an auction-sale annually.

I generally allow 1 inch in 12 inches for bark, but in the case of beech $\frac{1}{2}$ inch in 12 inches, or 16 and 8 per cent. respectively, but this is not always the case, as much depends on the age of the trees and the coarseness of the bark. This, however, can be taken as the general rule. I never pretend to give any more than actual measure, and do not believe in giving a foot and a half for a foot, for the sake of saying we have made a bigger price per cube foot than actually is the case. We have had a readier sale for timber than last year and a correspondingly better price.

F. MITCHELL.

North-west Somerset.—The demand for homegrown timber during the present year has, on the whole, been better than that experienced in 1906, with prices slightly higher. One had no difficulty in disposing of timber of good quality, but inferior stuff was a drug in the market and difficult to dispose of at any time. There has been a good demand for ash of good quality at very good prices. Oak has been rather hard to market if not of the best quality. Bristol is the nearest consuming centre, and, with such large quantities of imported timber coming into the port of Bristol, the prices for home-grown timber are not so high in this district as in the Midland counties, where there is a better demand.

These prices are for timber lying felled in wood and measured by string, and 1 inch in 12 allowed for bark down to 4 inches quarter-girth; smaller branches are generally sold at about 10s. per ton. The beech, sycamore, lime, horse-chestnut, sweet-chestnut, spruce, and Scots pine, were about 6 miles from the consuming centre, and rather difficult of access. The oak, ash, and larch had about 4 miles haulage with good

road; the elm was hedgerow grown, also about 4 miles distant. There is also a quantity of poles of the various kinds of under-wood which generally fetches a price ranging from 12s. to 14s. per ton lying in wood.

Prices rule as under:—

Description.				Butts per cubic foot.	Quality.	Tops and branches, per cubic foot.
Ash	...	...	...	1s. 8d. to 1s. 10d. 10d. to 1s.	First	8d. to 10d.
"	...	...	...	1s. 4d. to 1s. 6d.	Inferior	6d. to 8d.
Oak	...	...	...	1s. 2d. to 1s. 3d. 10d. to 1s.	First Second	7d. to 8d. 6d. to 8d.
"	...	...	...	10d. to 1s. 7d. to 8d.	Inferior	6d. to 8d.
Elm	...	...	...	10d. to 1s. 7d. to 8d.	First Inferior	5d. to 6d. 4d. to 5d.
"	...	...	...	10d. to 11d. 8d. to 9d.	First Second	5d. to 6d. 5d. to 6d.
Beech	...	...	...	8d. to 10d.		5d. to 6d.
"	...	...	...	8d.		4d. to 5d.
Sycamore	...	...	...	6d.		4d.
Lime	...	...	...	10d. to 1s.		5d. to 6d.
Horse chestnut	...	...	...	10d. to 1s.		5d. to 6d.
Sweet chestnut	...	...	...	10d. to 1s.		5d. to 6d.
Larch	...	...	...	10d. to 1s.	Good	5d. to 6d.
Scots pine	...	...	...	6d.		4d.
Spruce	...	...	...	6d.		3d.

The custom of measuring with the string and allowing 1 inch in 12 in quarter-girth still prevails in this district, and as far as I know in most places in the south. It is a very difficult matter to get a merchant to buy under any other method of measurement; and it is also the custom to measure the butt and price it at so much per cubic foot, putting the tops and branches at half the price of the butt.

It would be a great boon to agents and foresters who have to dispose of timber if they could have a fixed standard for measuring throughout the country, and I think it would be a good subject for the members of the Royal English Arboricultural Society to discuss through their QUARTERLY JOURNAL OF FORESTRY.

ASHTON COURT, BRISTOL.

HUGH REID.

Bolton Abbey and District.—There is not a large quantity of timber felled in this district, and what there is consists chiefly of small lots. These are occasionally sold

standing, to be felled by the purchaser, either for a lump sum or by measurement. In other cases the timber is felled by the estate men, and sold at so much per cubic foot.

The custom is to allow half an inch quarter-girth for bark, and to include all boughs of 6 inches quarter-girth and upwards at the same price as the tree.

The following prices have been obtained recently :—

Description.	Quality.	Price per cubic foot.	Remarks.
Oak	Good and fair size.	1s. 4d.	
Ash	"	"	
Sycamore ..	"	"	
Beech	"	"	
Alder	Good but small.	10d.	
Birch	"	"	
Elm	"	"	
Larch	Badly blistered.		
Larch	Good.	10d.	
Scots Pine ...	"	3d.	
Spruce ...	Rough.	"	
Beech	"	8d.	
Sycamore ...	Short and rough.	"	
Larch poles ...	Bad with heart rot.	9d.	
			For 9 in. quarter girth and upwards, about two miles from railway station.
			For all under 9 in., part of the above lot.
			Five to six miles from railway station and hilly road.

J. MITCHELL.

BOLTON ABBEY,

November 16th, 1907.

Deeside, Aberdeenshire.—In this district the present price of good Scots pine, standing in the wood, is about 5d. per cube foot quarter-girth measurement, from 5 to 8 miles from railway station.

Good larch of medium size, under similar conditions, is worth 10d. Sound tree of 30 cubic feet and over would be priced at 1s. to 1s. 4d., and large Scots pine at half that price.

J. P. ROBERTSON.

Disease in Lime Trees.—Referring to the note on the disease in Taurian lime trees in the October number, I communicated, as you suggested, with George Massee, Esq., of

the Royal Botanic Gardens, Kew, sending him a sample of the diseased bark.

He writes in reply as follows:—" *Nectria ditissima* is not the cause of this bark disease, which is known as **slime-flux**, and is due to the combined work of three species of fungi. Unfortunately very little is known as to the primary cause of the disease. However, it has recently been proved that if the glairy matter exuding from a wound of this kind is introduced into a minute wound in the bark of a healthy tree, fermentation is set up, and a weeping wound is the result of such inoculation. Wasps and flies appear to feed on the substance dripping from a wound, and carry the infection to neighbouring trees.

" The only practical remedy known is to cut out all diseased portions, cutting quite down to healthy wood, and dressing the wound with gas-tar."

TREVAL, NEAR TORPOINT, CORNWALL.

J. GILBERT.

Larch-blister, Strathfieldsaye, Hants.—Coming to this estate in the autumn of 1901, I found a large clearing made for planting.

Selecting larch as the tree to plant in most of the clearings, I secured good strong plants from different nurseries. All were planted in L system. In the spring of 1902, a late frost damaged them considerably.

More clearings having been made for the autumn planting of 1902, larch was again selected, but in the spring of 1903, the yearling plants, as well as those of 1901, were greatly damaged by late frosts.

Having considered the great need for an estate nursery, as soon as a suitable plot could be secured I had it laid out with seedlings of different species (chiefly larch) by the latter end of 1902. I also purchased several pounds of larch seed, sowing it in the last week of April, 1903, and secured a splendid show of seedlings, also cut back by late frosts.

Finding in the autumn of 1903 that the lined-out larch had made an average growth of 18 inches, it was deemed advisable to plant them in clearings made in the woods. A

late frost in the spring of 1904 once more damaged the plantings of 1901—02, yet those planted in 1903 from the home-nursery were not touched. I buy annually 100,000 selected seedling larch for the nursery, and transplant them to the woods the following autumn, and up to present time have scarcely had one damaged with frost.

As bracken and brambles grow strongly here, clearing operations are necessary. In these operations, in the summer of 1904, larch-blister was found to have broken out in the plantings of 1901—1902, chiefly where leaders had been damaged with frost.

Where a fresh leader had started, the damaged and dead ones were cut back, and all traces of blister cut out, and dressed with tar, no further traces of blister having since been found after this treatment.

In clearing operations, this summer, of first plants from home-nursery (area about 12 acres) only sixteen plants showed signs of disease. In six cases this was traced to spring-frost; in ten to damage in nursery lines, or to planter's heel.

I have also traced blister to damage done by beaters in the shooting season, as no doubt everyone has witnessed the unnecessary slashing a young tree gets from their sticks. This source of damage is now stopped in our young woods.

It has also been found that in removing double leaders or extra strong branches, if not pruned close, blister is sure to follow.

In lining-out seedlings, hoeing, planting, etc., great care is taken, all being done by day work, and under the charge of an experienced man, each man or boy being shown the various methods of transplanting and damage caused by the planters' heel, the hoe, bad pruning, etc.

PARK COTTAGE, HECKFIELD,
WINCHFIELD, HANTS.

W. R. BROWN.

Woods at Thirlmere.—The Thirlmere lake forms one of the reservoirs for the water-supply of Manchester, and the city owns about 11,000 acres of catchment-area around and

including the lake. As the average annual rainfall for thirty years has been 86·5 inches, and the soil is fairly light and the slopes well-drained, the growth of trees, especially of larch, beech and silver-fir, is splendid, and there is very little larch-blister. There are quite a number of larch 8—10 feet in girth and 100 feet high, and one silver-fir is 13 feet in girth and contains about 200 cubic feet. Unfortunately most of the older woods are open to sheep, but there are very few rabbits. Sycamore also grows splendidly, and sessile-oak, which is indigenous here, fairly well at low elevations, the level of the lake being about 580 feet above sea-level.

Hitherto the woods and new plantations have been excellently managed by Mr. Pattison, the bailiff, who has worked here for twenty years. The Waterworks Committee now propose to extend their plantations considerably, and have engaged an experienced forester to work under the bailiff's supervision, the latter having much other work to do. The quality of the local larch, beech, oak and Scots pine is very good, and as there is a great demand for timber and good prices are obtainable, while the export is easy, the city is thoroughly justified in planting up the rough land between the low pastures and the fells, which are used for sheep-grazing only in summer.

W. R. FISHER.

Mr. George Granville Leveson-Gower has been appointed a Commissioner of Woods and Forests in succession to Sir J. J. F. Horner, K.C.V.O., who has retired.

Official Notices.

THE Publication Committee of the *Quarterly Journal of Forestry* is as follows:—

Arboriculture.—H. J. ELWES, F.R.S., Colesborne, Cheltenham; A. HENRY, M.A., F.L.S., Reader in Forestry, University of Cambridge.

Entomology.—A. T. GILLANDERS, F.E.S., Park Cottage, Alnwick.

Home Forestry.—SIR HUGH BEEVOR, Bart., 17, Wimpole Street, Cavendish Square, W.; W. B. HAVELOCK, The Nurseries, Brocklesby, Lincolnshire; J. P. ROBERTSON, Edensor, Bakewell, Derbyshire.

Forest Education.—J. SMITH HILL, B.A., Principal, Agricultural College, Aspatria, Cumberland.

Irish Forestry.—A. C. FORBES, F.H.A.S., Dept. of Agriculture, Dublin; A. E. MOERAN, Palmerston House, Portumna, Co. Galway.

Mycology.—M. C. POTTER, M.A. Professor of Botany, Armstrong College, Newcastle.

Advertisements and Exchange Column for Plants and Seeds.—E. DAVIDSON, Assistant Secretary, R.E.A.S., Haydon Bridge, Northumberland. Advertising Agents, Laughton & Co., 3, Wellington St., Strand, London.

Foreign and Colonial Forestry and Chief Editor.—W. R. FISHER, M.A., 6, Linton Road, Oxford.

As the Journal is published on the 1st of January, April, July and October any papers intended for publication should be sent either to the Chief Editor, or to one of the Sub-Editors, before the 15th day of the month preceding publication of any Number.

ROYAL AGRICULTURAL SHOW AT NEWCASTLE, JUNE 30 TO
JULY 4, 1908.

A Forestry Exhibition will be held under the organisation of the R.A.S. of England and the R.E.A.S. Mr. George Marshall will be chiefly responsible for this exhibition, and the

Official Notices.

Council of the R.E.A.S. hope that every member who can possibly exhibit will do so, and that all the assistance required should be afforded to make the exhibition a success. A number of special medals will be offered for exhibits, full particulars of which can be obtained on application to Mr. E. Davidson.

ROYAL ENGLISH ARBORICULTURAL SOCIETY.

COMPETITIVE ESSAYS, ETC., 1908.

The following is a list of the subjects of essays for which medals will be awarded during the current year :—

1. The actual value of spruce as a timber tree in Great Britain.
2. The best and cheapest means of suppressing coarse grass on land which is to be planted.
3. The effect of wind upon the growth of trees.
4. The best means of propagating the different varieties of elms in England.
5. Any other subject connected with forestry.

Essays to be written on foolscap paper, under a *nom de plume*; to bear essayist's name and address in a separately sealed envelope, and to be in the hands of the secretary not later than the last day of May, 1908. The judges will have discretionary power in deciding whether or not any essay is deserving of an award. The medals for essays will be restricted to silver and bronze, and the council has decided that preference will be given to essayists who display original knowledge or research.

The society's gold medal will in future only be awarded for the best work on forestry, or some allied subject, that has been published during the year.

1908 SUMMER MEETING.

The council has decided in favour of the next summer meeting being held in Denmark, the date being, as far as can at present be seen, about the usual time, viz., the middle of August. As, however, the invitation of the Danish Government will probably be restricted to a party of 50, it was also agreed to arrange a visit to Ireland at the same time. Members will, therefore, be able to choose between the official summer meeting in Denmark and the supplementary meeting in Ireland. The annual general meeting will be held in England at a convenient centre, as in the case of the two previous continental tours. Full particulars will be given after the council meeting in March.

EDWARD DAVIDSON,
Secretary and Treasurer.

CONTENTS.

ORIGINAL ARTICLES:—

	PAGE
Notes on Irish Woodlands	91
Planting Sand-dunes at Holkham	103
Hainault Forest	109
Conversion of Ash Underwood into High Wood	113

OFFICIAL PAPERS:—

Forestry Exhibition at Lincoln	116
--	-----

REVIEWS:—

History of Lumber Industry in North America	123
Trees and their Life-histories	125
Indian Forest Utilization	126
Forestry in Encyclopaedia of Agriculture	129
German Arboriculture	132

CURRENT TOPICS AND SHORT NOTES:—

Report of the Forester, 1907, United States of America	136
The Black Walnut, a reprint	138
Sales of Timber	143



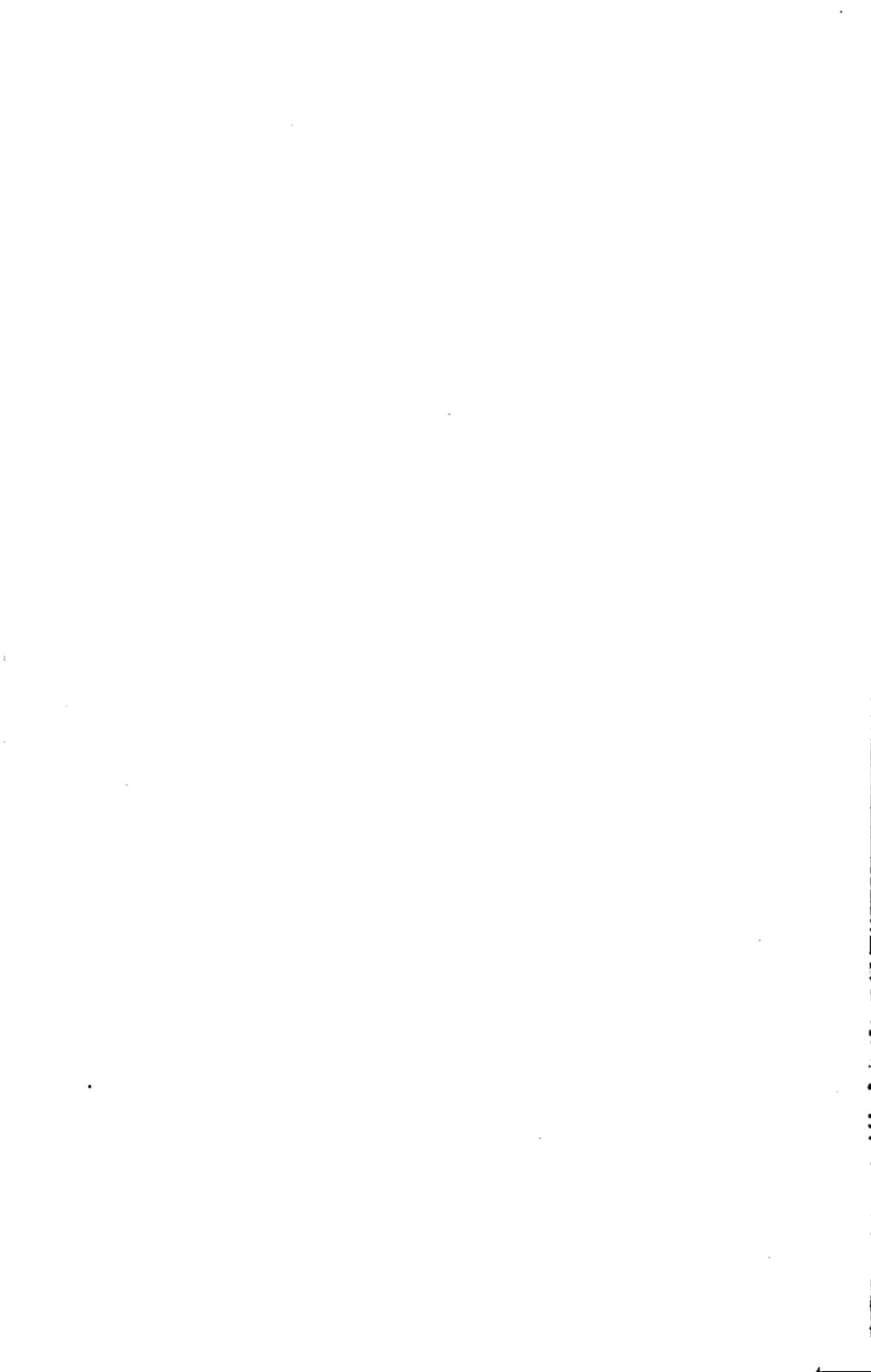




Photo.]

Gony & Co., Limerick

LORD CASTLETON'S IRISH PINES AT DONERAILE.

Girth 1 ft. from base	12 ft. 10 ins.	Height of first branch	50 ft.
" 5 ft. "	11 ft. 5 <i>1</i> / ₂ ins.	Total height ...	... 95 ft.
" 20 ft. "	10 ft. 1 in.		

Quarterly Journal of Forestry.

No. 2.]

APRIL, 1908.

[VOL. II.

Original Articles.

NOTES ON SOME IRISH WOODLANDS.

MY own observations in Irish woodlands are very limited : they are confined to short visits to woods of the Earl of Meath and of Viscount Powerscourt, near Bray ; to various estates in co. Wicklow in the picturesque country near the "Meeting of the Waters" ; to the Marquis of Headfort's place in Westmeath ; Lord Castletown's estate at Doneraile, co. Cork, and finally to Viscount Gough's beautiful place on Lough Cutra, and to some adjoining woods near Gort, in co. Galway ; also to the Forest School at Rathdrum.

In March, 1899, I read a paper on Irish Forestry before the Royal Dublin Society, and then, thanks to the kindness of the Irish Land Commissioners, I saw reports on woodlands in various parts of Ireland that were written, in 1891, by twenty Irish landowners and dealt with 10,300 acres chiefly stocked with conifers, mixed with broadleaved trees. It was there stated that the Earl of Erne had 600 acres of coppice-with-standards worked on a regular rotation, in which ash was the most valuable species, both as standards and underwood. This is the only instance I know of in Ireland where a woodland is managed so that equal areas are cut annually. It was stated that there was very little profit after deducting expenses, but if this area is still managed, as in 1891, it would be a valuable object lesson for the Rathdrum students, who should be taken to see the most interesting woodlands in Ireland, as well as in Great Britain. Apparently all other Irish woods, as far as I know, are cut when mature without any attempt being made to realise a steady annual revenue.

Evidently the existing Irish woodlands, all of which, with trifling exceptions, are in private hands, are unimportant financially, and are regarded by their owners chiefly for the amenity they afford to the estates as well as for their sporting value. It is very important that the beauty of the country-side should be maintained, especially as many of these woodlands are in very picturesque localities that are opened to the public by the kindness of their owners, and to this extent they merit State assistance. Under present conditions, however, the State is the principal landowner in the country, and as such should keep the country properly wooded, for agriculture and industry generally will not flourish without a sufficient supply of home timber and even of firewood. Bogs are certainly abundant in most parts of Ireland, but in certain localities, as in parts of co. Kildare, peat is becoming scarce, while during a wet summer, such as that of 1907, peat may be cut, but will not dry, so that firewood becomes a necessity. During last winter wood-fuel was being sold in co. Galway at 5s. a load for cut-up wood, and 3s. 9d. a load for long slabs, and this price was paid in the woods, the purchasers having to cart it home themselves.

The establishment of a forest school at Rathdrum by the Irish Board of Agriculture is a very wise measure, as without trained woodmen no advance in forestry can be made, and there should be no necessity for importing woodmen from Great Britain. It is unfortunate that all, or nearly all, of the formerly existing woods, except practically worthless under-wood, were cut at Rathdrum before the State acquired possession, but the land around the school is good enough to produce all the species that are likely to be grown in Ireland, and thus successful plantations will be raised easily, and will form polewoods for instruction in thinning, and mature crops ready for felling, very much sooner than if a poorer locality had been selected. The buildings also are well-adapted for a school, and its position in the S.E. of Ireland is in the midst of a country that is most suitable owing to the existence of large tracts of waste mountain land for the formation of State woods. The Board of Agriculture should keep in view interesting woodland areas in different parts of Ireland,

that are maintained under either private or State management, where thinnings and fellings may be taught to the students at once, until the Rathdrum woods are sufficiently old for the purpose, and where, even after this has happened, planting may be taught under more difficult conditions than those at Rathdrum. It is also essential that a good museum of forestry, including specimens of timber grown on various soils and at different altitudes, of destructive fungi, insects, etc., also of the industrial uses of timber and other forest produce, may be established. The best museum that I know of this kind to serve as a model is at Nancy, but there is also a very well-arranged one attached to the Botanic Gardens at Brussels.

I propose to give here a short account of trees that are now grown in Ireland, omitting the question of any further introduction of exotics.

BEECH.

Beech is especially suited to Ireland, as the tree thrives in a moist climate and on calcareous soils (so plentiful in Ireland), however shallow, and will grow on almost any soil that is not absolutely poor or sour. I have seen magnificent beech trees at Lord Meath's and at Doneraile, also in West Meath. Though at Lough Cutra the beech are much forked and very branching, I believe that is due to bad treatment when the trees were young, as there are a few straight and tall beeches there. The species is not indigenous in Ireland, but that is due to its not having reached the island before its separation from Great Britain and the Continent by the sea. Beech is now thoroughly at home and reproduces itself freely by natural seedlings, wherever rabbits are kept down.

I believe that the prejudice against planting beech owing to its alleged unsaleableness is because a sufficient quantity of the timber is not usually available in any locality, and that frequently the trees have been grown badly. The demands for beechwood are steadily increasing in Great Britain, and many of the reports received from wood-merchants by the Forestry Committee show that it is quite saleable in Ireland at the present time. Irrespective, however, of its sale-price the

planting of beech in mixture with other trees, and especially with conifers, is advisable for the following reasons :—

(1) The formation of mild humus by its dead leaves, which also retain moisture near the surface of the ground, and from which the roots of other trees may obtain perennial supplies of nutriment.

(2) All trees when properly mixed with beech grow straight, tall, cylindrical and free from knots, and thus produce high-class timber.

(3) A mixture of beech renders a crop of trees windfirm, the importance of which was shown by the destructive gale of 1903.

SESSILE OAK.

Sessile oak is indigenous in Ireland and in all the more rocky western parts of Great Britain. In the existing crops of rough native woodland, usually on very stony ground, this tree, with birch and hazel, and ash underwood, usually forms the bulk of the standards. In such places the boles of the oak trees are short and their rate of growth after sixty years very slow, so that for a foot of diameter under bark at chest-height there are about sixty annual zones of heartwood and forty of sapwood, the latter not exceeding two inches on the diameter.

This very slow growth is due to the bad locality in which these scrub oaks grow, but I have seen very good sessile oaks near the "Meeting of the Waters," and before condemning the Irish oak as a slow and unremunerative grower, countings of the rings of well-grown trees should be made. At Vyrnwy, in Wales, on moderately good rocky soils and at altitudes of about 800 feet, the sessile oak attains a girth (under bark at chest-height) of 21 inches in diameter with 2 inches of sapwood in eighty years, and its rate of growth in similar soil in Ireland should at least equal this.

The stunted oaks also yield very valuable timber, as I saw near Lough Cutra, and their regeneration is always from fallen acorns, and therefore easy and economical.

ASH.

Ash is the most valuable indigenous broadleaved tree in Ireland, and its natural regeneration is abundant wherever

rabbits are kept down. I have visited a wood near Gort (co. Galway), where 1,500 ash trees have just been felled, the wood being considered good enough for tennis-racquets. The best quality of ash-wood in the world is grown in the British Isles, continental countries such as Europe generally and America producing somewhat brittle ash-wood. It is usually a mistake to keep an ash tree standing too long, as its heart is liable to become dark and brittle. The trees just referred to are seventy years old and about 14 inches in diameter at the base of the felled logs. Ash that is not too old after it is as thick as a man's arm is serviceable for many purposes.

SYCAMORE.

Sycamore is another very valuable tree, but I cannot remember having seen any fine trees of this species in Ireland, though its natural seedlings abound in some of the woods I have visited. Probably the fine sycamores have been cut and sold, as wood-merchants will go any distance to secure them.

SWEET-CHESTNUT.

This tree will grow to a great size on lands that do not contain 4 per cent. of lime, and in Ireland the wood does not appear to become shaky, even when of large dimensions, as Mr. Forbes pointed out to me at Rathdrum. There is very little sapwood, even in quite young chestnut poles, and the wood is extremely durable when used for fences and posts for wire-railing, the best tests for durability of timber.

ALDER AND BIRCH.

In the reports drawn up in 1891 it was stated that there were then 1,000 acres of alder-wood at Kenmare. Both alder and birch (the latter growing everywhere from natural seed and frequently being a nuisance in coniferous woods) are used for clog-making and bobbins. In Lord Gough's wood, Gortcanane, about fifteen years ago, clogs were made of birch, and a weigh-bridge still exists where the roughly-hewn clogs were weighed, the produce being sold by the ton.

There is an interesting crop of grey alder at Doneraile, the

ground being covered with its suckers. This species is particularly useful on very stony ground.

In a previous report, I have dealt with poplars and willows, while elms are grown chiefly as hedgerow and avenue trees. *Robinia* is grown easily on sandy soils, and is coming into use for spokes for motor-cars.

LARCH.

Among conifers larch is *facile princeps*. This tree thrives in Ireland, but usually is cut too young to attain large dimensions. There are, however, splendid old larches at Doneraile and Lough Cutra, and doubtless in many of the beautiful parks in Ireland. It is here particularly free from disease (*Dasyscypha calycina*), and I cannot say that I have noticed any diseased trees, though such exist in co. Sligo and elsewhere. Given suitable soil and proper treatment, including early thinning and subsequent covering the ground by underplanting the crop with shadebearers, there need be no fear of planting larch on a large scale in Ireland. My own experience is that the growth of larch is immensely benefited by a mixture with beech, either on starting a plantation or by growing it pure at first and underplanting with beech after the first thinning. Calcareous soil and a suitable altitude are highly beneficial to the quality of larch-wood; THE WOOD IS REDDER, HARDER AND HEAVIER, AND THE TREES ARE MUCH MORE WIND-FIRM ON CALCAREOUS THAN ON SILICIOUS SOILS, while in co. Cork, on the Ballyhoura hills, the quality of the hill larch-wood was said to be vastly superior to that grown lower down, and it was recently sold standing at 12s. 6d. a ton. I measured the rate of growth of samples of 700 larch trees that had just been felled on shallow soil upon mountain-limestone near Gort, and it appears to be about 20 inches in diameter under bark at the base of felled logs in 65 years, 45 years heartwood and 20 years sapwood, the latter measuring only 2 inches on the diameter. Mr. Bagot, at Ballyturin near Lough Cutra, had some fine larch, which unfortunately I did not see, but for which he was offered £2 a tree. The usual mixture of larch and common pine is useless, as the latter becomes very branchy and is soon dominated by the larch. This I saw at

Ballereigh (Lord Powerscourt's) where also there are some giant thuya growing with the larch, and the thuya was increasing in diameter faster than the larch.

Instances of good prices for larch-woods are common near Bray, one being supplied me in 1899 by Colonel Bayley of Killarney Hall. The total value of the timber on 1½ acres when 64 years old was £190, or £127 per acre. All was sold except 70 trees worth £50, so that £93 per acre was actually realised, after paying 10s. a ton for felling and transport to Liverpool.

THE COMMON PINE.

The name Scots Pine for a tree which grows all over Europe from Spain to Russia seems very inappropriate, and I propose in future to call it "The Common Pine." This tree is indigenous in Ireland, and the red heartwood on stumps of old pines may be seen anywhere under shallow bog in the Wicklow Mountains, as was shown me by Mr. Forbes. There are some immense pines at Doneraile (frontispiece), which are said to be indigenous and have certainly an appearance unlike any pine that I have seen. Near Gort, in co. Galway, on mountain-limestone this species attains 28 inches in diameter at the base of logs, in 90 years. It grows everywhere in Ireland, on rising ground above the bogs and in the bogs, provided they are not too wet, and reproduces itself naturally from seed. It is probably the best species to start with on cut-away bogs, but its planting was a complete failure in some wet land (old red-sandstone), inspected, to the S.E. of Lough Cutra, called the Burned Wood. The plants put in after the fire are all turning red and losing their leaves, while the mountain pine growing with them is strong and vigorous. Unfortunately the dwarf variety of the mountain pine has been chosen. For wet, high, shallow, boggy land in Ireland there should be no better tree than *Pinus montana uncinata, var. rostrata*, the erect variety of the mountain pine, which grows straight and tall and with very few small branches, so admirably described by Sir John Maxwell in the last number of the "Proceedings of the Royal Scottish Arboricultural Society." Its wood is very tough and elastic, and as it resists snow well it must be very windfirm. The seed can be

obtained through the British Embassy in Paris, from the French Government.

CORSICAN PINE.

The Corsican pine appears to be little cultivated in Ireland, where the branchy Austrian pine is sometimes planted in shelter-belts. No tree stands gales better than Corsican pine, its growth is fairly quick, it will grow on very poor soils, and its seed germinates most freely, so that it is a cheap tree to sow. Transplants are costly to buy in sale-nurseries, but can be raised without much difficulty in home-nurseries. Great care must be taken in planting this species, but experience in Wales shows that small transplants, or even two years seedlings, are easier to plant than larger transplants, and that they force their way readily through herbage. It is quite possible to sow this species directly on a felling-area, or on wasteland where the heather is not too strong. Planting should be done either in March or October.

SILVER-FIR.

The silver-fir is eminently suitable for the Irish climate and is indifferent as to soils, provided they are not sour and the roots can get down to a moist substratum. It reproduces itself freely from seed, wherever there are no rabbits and other undergrowth is sufficiently kept down, and it withstands shade better than any economic conifers. Near Gort, on mountain-limestone, this tree at the base of felled logs attains 27 inches in diameter under bark in fifty years, the wood being perfectly sound. I have not noticed any attacks by aphis in Ireland, where the tree appears to be particularly healthy, but in the drier climate of Fifeshire it is impossible to rear common silver-fir, owing to this pest, while *Abies grandis* appears to be immune, both in Fifeshire and near Oxford. It has been sown successfully at Yvrnwy under larch poles.

SPRUCE.

Spruce near Gort on mountain-limestone had all died from red-rot, and when one considers the great liability of this tree to

windfall and to red-rot when over fifty years old, its plantation, except on silicious soils or clay, is of doubtful expediency except for use as paper-pulp. The fact is, that in its native country it grows naturally at a much higher altitude than silver-fir, and cannot be expected to thrive in the lowlands. *Picea Sitchensis*, Menzies' spruce, is a plains tree, and is probably more suitable than Norway spruce for the lowlands.

DOUGLAS FIR.

I have seen scarcely any Douglas fir in Ireland, though a few are growing fairly near Lough Cutra. This species will not thrive on calcareous soils and cannot withstand gales. In sheltered places and on deep loam or even clay or on peaty sand, its rate of growth is very rapid, and its timber second in quality only to larch. In the reports of 1891, already alluded to, it is said that 50,000 Douglas fir had been planted at Kenmare, and the present condition of those trees is of interest for the Rathdrum students.

WOODS NEAR GORT.

While I stayed at Lough Cutra Castle, Lord Gough kindly showed me some woods that are highly interesting, as they illustrate what may be done with natural Galway scrub.

The country between the small town of Gort and the sea consists of a stony tract of mountain-limestone, the surface being often acres of bare rock, gradually rising in terraces to 1,300 feet altitude in the mountains above Galway Bay. The only traces of vegetation on these rocks are an occasional holly or procumbent juniper from seeds that have germinated in a crevice. There are a number of large patches of bog in depressions in the limestone, and other tracts, where there are meadows, are liable to inundations during winter, but in a normal summer the surface water disappears, so that it is difficult to get water in the district for sheep and cattle. Even the Owendarullagh River, which rises in moorland on old red sandstone, and flows through Lough Cutra, plunges into the limestone at the Punch-bowl, after traversing a deep and most picturesque glen. This glen is well stocked with trees: beech, larch, pines, oak and ash, the oldest of which were

planted in 1760, but have been somewhat thinned by the gale of 1903. This glen also contains on an eminence a prehistoric circular camp with subterranean dwelling-places, and altogether forms an extremely interesting spot. Across the river are about 200 acres of hazel scrub with seedling ash.

It is fortunate that when the adjoining farms are to be acquired by the tenants the glen and its woodlands were, by special permission of the Land Commissioners, reserved by Lord Gough, who maintains the whole of this picturesque place and the footpaths through it, while it is open to the public. The river reappears and disappears several times in deep holes and comes out again above Gort, but after continuing its course above ground for a mile or so, descends again and proceeds underground to the sea.

On this limestone with a soil of variable depth, usually shallow, and which has been formed by the decomposition of the rock under the humus of an old native oak wood, there is a wood of about 350 acres named Garyland and belonging to Mr. Shore Taylor. It was originally stocked with sessile oak, ash, hazel and birch, with some holly and an occasional old yew tree, the latter usually on very shallow soil above the rock. About ninety years ago it was interplanted with common pine and beech. The keeper said that seventy years ago much oak was felled here and sold for £10,000. Further replanting with larch, silver-fir, pine and beech followed that felling.

Last year 3,214 trees were carefully marked for felling by Mr. Moeran, of the Irish Forestry Society, and were sold standing by private contract to a Scotch wood merchant, who has erected a temporary sawmill in the wood. The following trees have been felled:—

Ash	...	...	...	...	...	...	1,502
Larch	...	...	...	...	...	..	717
Common Pine	...	...	...	...	...	...	493
Sycamore (?)	...	...	...	...	...	...	204
Oak	...	...	...	...	...	...	171
Silver-fir	...	...	...	...	...	...	73
Beech	...	...	...	...	...	...	54
<hr/>							
Total	...	...	...	...	...	...	3,214

Owing to the shallowness of the soil, the length of bole of these trees rarely exceeds 30 feet, and their diameter-growth has been already described. They were all ripe for felling, though perhaps the silver-fir might have been left to help sow up the ground. There is abundant natural regeneration of ash, beech and sycamore and plants of young oaks, also naturally sown. If the useless hazel underwood and badly-shaped oaks were removed and the promising oaks pruned, while larch and silver-fir were planted in the gaps made by the felling, the future prosperity of the wood would be secured.

The absence of rabbits from Garyland is accounted for by a disease which is said to kill them off about every five years, and to which it is to be hoped they will not become immune. When they feed on the wet herbage in the *turloughs* or *Callows*, as the annually flooded meadows are called, the rabbits become infected with flukes from certain gasteropods, the species of which I do not know. These flukes eventually attack the livers of the rabbits.

It is interesting to note the various kinds of sawn timber that are being prepared at the mill. Nearly all the ash, of very good quality, had been removed when I saw the sawmill, and was chiefly to be used for making tennis-racquets; the oak was being converted into 16-feet planks for railway-wagons or into short palings; the larch into 4-feet sleepers for tram-lines in coal-mines or into planks for pit-lorries. I did not see any sycamore. All the side-pieces were being sold at the sawmill for firewood, the purchasers carting them home and paying 5s. a cartload for slabs sawn up into short pieces, and 3s. 9d. a load for the full length slabs. The merchant also sold short pieces at the reduced price of 3s. 9d. a load to a charitable society that was supplying the poor of the neighbourhood with firewood, as fuel is very scarce owing to the impossibility of drying the peat last summer.

I visited another wood called Gortcanane, that belongs to Lord Gough and is a famous woodcock cover. Its area is about 300 acres on old red-sandstone rock; it is also a natural wood, but the sessile oak is even more stunted than in Garyland, except to the north, where there is more soil and the trees are

straighter, taller and larger, there is also much birch and hazel with some ash. Beyond the wood to the north is the river Owendarullagh, which winds considerably among the low sandstone hills before passing into Lough Cutra. On the north-eastern border of the wood is more birch and an extensive bog, from which the wood itself, like that of Garyland, is entirely free. Gortcanane is very wet in winter, and its soil, where insufficiently stocked with trees and underwood, produces bilberry and bracken. There is a small clump of larch about 35 feet high and thirty years old that requires thinning ; I also noticed one Douglas fir growing well and a few vigorous silver-fir. From the higher land north of the wood I saw a much better wood, Chevy Chase, well stocked with conifers, but had no time to visit it. Beyond the bog are stretches of hill moorland without any trees and used for cattle-grazing, though not, I should imagine, of much value for that.

It was from this wood that fifteen years ago a quantity of birch and ash was cut into clogs. It would be best now to clear the wood in about twenty years, leaving any straight oak and ash saplings, and to stock it with larch and silver-fir, as I doubt whether beech would grow on the wet sandy loam.

Besides the above woods there are some fine plantations of larch, silver-fir, and other trees at Mr. Bagot's place, Ballyturin, which I did not visit, and there are some areas of hazel and ash scrub, besides a few coniferous plantations belonging to Lord Gough. It is evident that the stock of wood in this district is quite insufficient even for local purposes, and all existing woodlands should be kept up and their stock improved. It would be also worth while ascertaining whether there are suitable areas for planting trees in the vast wild surrounding moorlands, or even on the rocky mountain-limestone, which, wherever there is any soil on it, will produce excellent larch, beech, and silver-fir. There is a wood about three miles long, also on mountain-limestone, at Weston-super-Mare, where larch, ash, beech, and pedunculate oak grow well, while outside the wood the rock is almost as bare as near Gort ; the heart-wood of the larch there is just as red and hard as at Garyland, and the larch trees very windfirm.

W. R. FISHER.

THE PLANTING OF SAND-DUNES AT
HOLKHAM.

IN 1897 the English Arboricultural Society visited Norfolk for their annual excursion, and during their day on the Holkham demesne a brief period was spent inspecting part of the planted dunes. Many members expressed themselves surprised at the thriving condition of the pines, growing in pure sea-sand, and naturally asked what special means or method had been employed.

Since then many members of the Society and others, all interested in such undertakings, have visited these sandhills, as they are commonly called; others have written making inquiries as to the best way to proceed in similar cases.

Various opinions are expressed relative to the financial aspect of such work, the wisdom or otherwise of planting trees so widely apart, and of the selecting of the species most in evidence; therefore a few words on the method of planting employed, the different species selected, some of the reasons for wide planting, and the present results (which have justified the original scheme), may encourage others, with a similar sea-board to contend with, to add a new and distinctive feature to their coast-line by a system which has one great recommendation: the small expense involved per acre.

As far back as the 'fifties experiments were tried by sowing pine seeds in balls of clay. This, however, did not answer. Planting was then tried, the plants being put in favourable spots in the sand, protected carefully, and duly watched. At the end of the first year all the plants were found alive, having made one or two inches growth. Lord Leicester's attention was drawn to this, and, struck with the possibilities of such planting on the bare, cold, and desolate sand-hills, he started forthwith, and has lived to see them planted from end to end in a tract about three miles long.

No particular method of filling up the ground regularly seems to have been employed for many years, nor any particular area laid out to be planted in a season, the idea being of putting a plant in a favourable spot rather than planting a stated number per acre at a given distance apart.

From the latter part of the 'seventies another plan was adopted, hills being planted with Corsican pines 8 yards apart and the ground filled with Austrian, Scotch, and Maritime pines 4 or 5 yards apart. The larger flats were planted with Corsican pine at the same distance and made up to 8 feet apart with Scots pine. Later on, the hills were planted with Corsican pine, mainly at 6 yards apart, Austrian pine being used to break the wind on exposed places, and Scotch pine on the sheltered sides, to vary the colour with its silvery foliage.

Plants were raised from home-grown seed, excepting maritime pines, which were bought as two-year seedlings. These were reared in a nursery not a mile from the sand-hills, sheltered with holly hedges, otherwise with a northern or sea exposure, thus partially acclimatising the plants. The length of time they were in the nursery varied from two to four years, as circumstances permitted, but whether it was long or short, they were moved every year, so that each plant had a short, sturdy head, with a regular mat of roots, when ready to go out. This, no doubt, has been the secret of success in the first instance, as losses never came to more than 1 per cent. and filling up was not necessary. Great care was exercised in moving plants from nursery, the men never being allowed to rush work and being closely supervised. The area to be planted was marked off in equilateral triangles with a line and stakes, a plant going in every angle. So many men opened the holes, and so many came behind planting; the former lot carried forks as well as spades to fork out all marram grass roots, to give the young plants time to start growing before the marram closed round or overshadowed them. The planters always had to make the tree as firm as possible and mulch with marram forked out by the others, these being most important points.

Spring-planting was adopted always, the months of March and April being the most favourable. This suited best in every way, as plants put in in the autumn were blown about and got loose at the neck; labour was more abundant in the spring, and generally finer weather, with longer days, prevailed.

The total outlay involved per acre varies from 10s. to 20s.; no protection was required, rabbits being stringently kept

down, and after-expense was practically *nil*. No planting to succeed in its object was ever done cheaper or succeeded better.

Of the species employed, Corsican pine has proved by far the best all-round tree. It will stand a large amount of exposure to the sea-winds, rabbits do not seem to touch it, and it rarely loses its conical habit, standing as it does quite isolated in many cases; above all, it thrives luxuriantly, and is most reproductive in favourable situations.

Austrian pine has been found very useful on all the northern or sea exposures. Even on the outside of the hills, with the one side bare to the stem, it will form a thick bush on the other side, allowing its neighbour on the inside to go one better.

Scots pine answers best on the landward side, where it grows well, breaking the monotony of the two darker-leaved pines, its silvery hue showing very distinct against them. On the flats where planted at 8 feet apart, the trees being very rough, they have provided a large quantity of faggots for sand-fixing by lopping off double tops and over-strong laterals, it being a great consideration to have them on the spot when otherwise they would have to be carted for three or four miles.

These are the only three species planted now for many years, *Pinus Pinaster*, used a good deal at one time, being entirely given up. Here it invariably has a straggling habit of growth and a bent stem.

P. insignis was tried, two only being now alive, but doing well, and though subject to attacks by pine-beetle, will seemingly be a useful tree for such work. Larch have been planted on some of the flats, but only in a few spots have they come to anything. Silver-fir, giant thuya, and *Cupressus macrocarpa* have been planted, but do not grow to be of any use.

Wide planting was no doubt adopted at the outset by chance; as before mentioned, plants then were put in favourable positions, such as a hillock of sand on a shingly flat, a depression in the hills sheltered from the north, or any slope with a southern aspect. As time went on, this was seen to answer, the trees were clothed to the ground; and where shelter was a predominant necessity for the valuable adjoining marsh-lands, what better way could it be

secured permanently than by allowing trees room enough to prevent them from killing the lower branches of each other?

Ornament was a prominent reason in the planting of the dunes, as they are, for several miles, a very prominent feature from the adjoining uplands; besides, it was the point of most interest to the proprietor, and wide planting secures this better and cheaper than close planting would have done.

Timber was never a consideration, even after the experimental stages were passed, and the topography of the dunes was against it, as the average width is not more than 300 yards, and the length three miles.

Even now it is not possible to say that such situation as these dunes would carry a crop of timber, starting with some 2,000 plants per acre. Where the flats have been planted up to 8 feet apart, they are not a success. In some cases many of the trees have died on touching each other, though this may be due to wet land; in others, the Scots pines are very rough, and make no height growth. However, this could be explained by the distance being too wide at the outset for the trees to clean and help each other.

Patches of both Scots and Corsican pine seedlings, standing 2 to 4 feet apart, are thriving and look like making useful timber, but these patches are small in extent and situated favourably and only some twenty years of age, so they cannot be taken as an instance of how much could be grown on a large scale.

Trees having plenty of light and air bear heavier and better crops of seed than close-planted, drawn-up plants would do. Consequently natural reproduction is very strong, and present results tend to show that, taking everything into consideration, wide planting has been justified.

A map of Holkham, dated 1843, shows the older-planted part of these dunes practically surrounded by water, with no proper access, nothing more than derelict land, a refuge for wildfowl and rabbits. To-day there is a carriage-drive from one end to the other, and to a lover of Nature a most interesting drive it is, with always something different at every bend.

In May of last year the Royal Commission on Coast Erosion

visited Holkham on their tour of inspection round the coast. Naturally, they were very much struck with the tree-growth on the dunes; also with the great gain of land from the sea during the last twenty years or so. Since then they have wished for "evidence on afforestation as a means of sea-defence," and also "if it is practicable to grow a commercial crop of timber on such situation."

Afforestation was not considered as a means of sea-defence here, only in a secondary or indirect manner. The marram grass (*Psamma arenaria*) has been and is the chief agent in sea-defence, holding or gathering the sand blown by the wind, with faggots to strengthen and quicken the process in the weaker places, and the grass always encouraged in its growth by fresh deposits extends seaward and upward. Once the dunes are practically safe, afforestation follows as a natural sequence, the trees killing the marram slowly but surely, both by excluding light and by their falling needles; also by preventing the sand from shifting, fresh deposits of which seem to be necessary for marram. The marram gone, the trees commence their work; this being more land-reclamation than sea-defence. This is proved by the seedlings of many different kinds growing wherever the original conditions have been ameliorated by shelter, humus, etc.

Pinus Laricio are coming up by thousands. In spots where there is no other growth but mosses and lichens, they can be seen, struggling for existence at first, but gradually growing faster each year as the roots extend through the shingle. Many saplings are as high as the parent trees, making 18 inches to 24 inches of growth annually, with the result that trees twenty years old are 30 feet to 35 feet high, and often standing 2 feet to 4 feet apart. Scots pine regenerates almost as freely as the *P. Laricio*, and grow very rapidly where conditions are favourable. In small numbers can be seen seedling Austrian and maritime pines. Among hardwoods, oak, walnut, hawthorn, birch, sycamore, willows, etc., all seem to thrive; their seeds must have been carried by birds or by other means, as no deciduous trees have been planted.

Privet, elm, honeysuckle, and elder strike root from the faggots put in to hold the sand, thriving in the coldest spots,

and by spreading they form mats or hedges, according to their habit of growth, all helping towards the goal of land-reclamation.

In conclusion, three of the unplanted flats are worthy of notice, as instances of the reproductive powers of the wide-planted trees adjoining them. No. 1 is some 30 acres in extent, part of the marshy ground reclaimed from the sea in the 'sixties, but, owing to its low level, never cultivated. Consequently, it is covered by rushes and other rank grasses, no stock being allowed on it, and though bounded only by trees to the north, it is fast becoming a natural wood or forest. Many hundreds of Scots pines have sprung up, some now being 10 feet to 15 feet high; Corsican pine, larch, birch, and willows, are slowly covering the ground. Many seeds must have been blown or carried 400 yards, and for one that has germinated and grown a plant, a hundred must have perished, so rank is the marsh vegetation.

No. 2 flat is even lower-lying ground than the former, occasioned by the removal of many thousands of tons of sand and shingle to form a sea-bank. It is situated in the centre of the dunes and water often stands on it in winter. Though surrounded on all sides by trees, regeneration has been a more gradual process here, conditions being most unfavourable. Scots pine is the predominant seedling, and is slowly ousting the sallows, the first tree-growth, from the ground, drawing in from every side, choking everything in the way, till now there are places where it is hardly possible to get through, so dense are the seedlings on the ground. No. 3 flat is a formation of recent years, it being outside or to the north of the original planted range of hills. Between twenty and thirty years ago, big tides flowed into it, but new dunes springing up have shut out the sea. To-day it is carpeted with Corsican pine seedlings from 3 inches to 2 feet high, not very thick on the ground, but increasing year by year, and will soon be one of the best samples of natural regeneration on the sand-dunes.

D. MONRO.

HAINAULT FOREST.

THIS is the property of the London County Council, and was acquired in 1903 under a special Act of Parliament.

The moving spirit in securing this fine woodland and open space for the public was Mr. E. N. Buxton, without whose generosity and public spirit the scheme would scarcely have arrived at a successful issue.

Although the name is spelt in the same way as that of the Belgian Province, in origin it is believed not to be Norman French, but derived from the word *Hain*—which we find in the German *Hain-buche* is the equivalent of the English *horn* in *Horn-beam*, the timber of the hornbeam is sometimes called provincially by joiners, *horn-wood*—and *Holt*, Anglo-Saxon and E. Anglian for “wood,” and now used only provincially for wood and woodland. The area actually under wood lies on the north-western border of the “forest,” and comprises some 250 acres. The remaining two-thirds of it is open grass land, with the exception of some new plantations on the eastern rise, which is separated by a depression draining into the sea from the woodland on the west. The works of reafforestation, etc., consisted “in forming a considerable number of enclosures on the arable land and planting them with gorse, broom and a considerable variety of forest trees.” Also, “In accordance with a provision in the special Act, a plantation, six acres in extent, has been formed alongside the Romford Road, opposite to Hainault Lodge, planted with 1,750 trees of various kinds and surrounded with an unclimbable fence”; this, no doubt, in order to protect a reservoir of the South-Eastern Waterworks. The treatment of the 251 acres of land already under forest is officially described (July, 1906) as follows:—

“In the forest itself the leading principle has been to preserve its natural beauty without interference. For the convenience of the public, some of the forest walks which had become overgrown have been widened in places, and here and there a glade has been opened out in the boggy places, the walks having been raised and culverts constructed. Dead trees have been cut down and the trunks utilised for rustic seats.”

Before attempting to criticise the actual management in the

light of this statement, it must be observed that the term "natural" rather begs the question, since the former method of treatment, and one that has been only recently stopped, was to pollard the hornbeam which forms the greater part of the crop. The oak, being a royal tree, has escaped this treatment, but the method of working the forest as a whole is most distinctly artificial, and any approach to a more natural state of things cannot be reached until the majority of the old pollards have been removed.

The forest portion is interspersed with several glades, so that there is plenty of space for picnickers. The ruling species is oak, with an underwood of old pollarded hornbeam. During the last few years the area has been enclosed, rabbits are kept down, and pollarding has been stopped, so that one can now find young hornbeam growing under natural conditions. The result is a plentiful crop in places of oak, hornbeam, whitebeam and service-tree seedlings. In the more open places "forest weeds,"¹ including holly and thorn, which have not been cleared, are springing up. It would be better, perhaps, where there is an excessive growth of weeds, to clear them out more frequently, enclosing small cleared patches to protect existing seedlings of superior species, and filling up blanks with strong plants of oak, ash and beech, while taking care that the holly, which is perhaps too carefully preserved, does not suppress them; for the holly is becoming an invading species. A few clumps of fine holly in the open may be encouraged, but in woods whose use is primarily for recreation it is perhaps best grown chiefly as underwood, since the growth is then rarely so thick that circulation is impeded. On the other hand, a large tract of dominant holly if left unchecked

¹ The word weed is used in the technical sense to denote plants that are not required or which are present in excess in cultivated ground.

In a small area of woodland destined as a playground for the large population of London, space should be utilised to the very best advantage; this entails artificial management or "cultivation" in the broad sense. The beauty of the holly or thorn has little to do with the question whether too much space is not given to either, in which case they are as truly "weeds" as red poppies or blue corn-flowers in a wheat-field.

is apt to grow into an impenetrable mass which can be viewed from the edges only.

The number of overgrown hornbeam pollards, which is excessive, is being reduced slowly, a step in the right direction. A few of these are quaint objects and may be preserved so as not to make too violent a break with past history. If the formation of beautiful woods with reasonable speed is a consideration, the removal can go on much faster—blanks being enclosed and planted as recommended above. There is also a tendency when clearing out rubbish to isolate too much the larger poles and saplings, and they will make all the finer trees for being grown comparatively crowded when young ; this applies especially to the oak, much of which is branchy and stagheaded, the result of pollarding the hornbeam having encouraged the growth of side branches. All the oak requires is to have its head free and sufficient space for the healthy development of its crown.

However, progress at a more rapid pace would cost money, and since in England drastic measures in forestry are often undertaken on wrong lines, it is certainly better to proceed tentatively and cautiously than to produce striking effects quickly, unless experience and skill in forestry enable a competent manager to know clearly the effect of what he is doing and allow him to be sufficiently confident of the result.

The only real criticism that can be offered on the measures now adopted within the allotted expenditure is, that, as is generally the case in England, it is not sufficiently realised that fine oak trees cannot be grown except in comparatively even-aged clumps, and that the trees that are to endure must not be isolated too young. It is forgotten also that if holly is allowed to come up too thickly, and the oaks and nobler species not favoured in some way, it may take complete possession of the ground, forming at last impenetrable thickets which cannot often even be properly seen, and thus occupy valuable space to no purpose. If grown as underwood, its lower branches die off under the increased shade of the overwood, and when this result has been obtained the upper storey may be removed gradually here and there so as to form

clumps of holly under which it is possible to walk. One feature deserves the highest praise: neither in the remains of the ancient forest nor in the new plantations have any conifers been planted, thus doing away with that patchy effect seen so often in English woods and parks, where they have been introduced in a haphazard way. If conifers are to be employed at all, a few new plantations may be formed almost entirely composed of them, so as to afford an element of diversity in the area; but they should be kept well away from the older deciduous woods, being frankly recognised as something new and artificial, and not intended to mingle, either as single trees, or clumps, with the original woods, or to introduce a new element into their distinctive scenery. Since the whole area is intended as a playground for Londoners and any treatment must be to that extent artificial, there is really no reason why, if these conditions are observed, coniferous plantations should not be formed; nor, again, is there any reason, except sentiment, why in the younger hardwood plantations on land that has long been cleared, such trees as horse-chestnut, laburnum, robinia and others may not be introduced for ornament, provided that they are so placed as not to intrude unpleasantly or create a jarring note upon views of the older natural woods. Even the hornbeam, which is here so obviously at home, is considered by some authors as an introduced tree, so that no hard-and-fast line can be drawn unless one is prepared only to employ such trees and shrubs as are truly indigenous in the neighbourhood; and according to this the broom, which has been employed in places with the happiest results, must be ruled out. On the whole, therefore, with the exception of occasionally pushing a sentimental theory too far, the forest management of the area is distinctly a commendable one, and likely to achieve its purpose.

The younger plantations are from two to four years old: they comprise beech, oak, hornbeam, ash, birch and thorns, they are mostly healthy and thriving, and though often in exposed situations, seem to do very well without the usual admixture of conifer nurses. The whitethorn is used here partly as a nurse and as a shelter-belt, though as a deciduous tree it is not very effective for the latter purpose. If there

is any criticism to make, it is this, that occasionally too many different species are mixed on a small area and that the plants are spaced too widely. If fine clumps of wellgrown timber in park land are desired, there is no better method than that adopted by the Duke of Bedford, viz., form plantations of two or three species, such as oak, ash and beech, of one to three acres in extent, grow them thickly for thirty-five or forty years, until they have attained a good height growth, and poles have cleaned themselves of their lower branches. At this stage, thin strongly, taking out all but the best shaped dominant trees, remove the fence and allow the clump to grow on without further treatment than removing decaying trees. In some such way as this only can the finest park timber (with the exception of elms) be produced. In fact, when young it should be treated as ordinary high forest for the production of timber. Such a procedure takes time and requires plenty of space ; but in the present instance both these conditions are on the side of the managers of Hainault Forest.

3rd March, 1908.

A. P. GRENFELL.

CONVERSION OF ASH UNDERWOOD INTO HIGH WOOD FROM STOOL OR STEM SHOOTS.

THE county of Hampshire, being famed for its underwood, large cuttings take place annually on this estate. As is well-known, the underwood trade is practically gone, it being now a difficult matter to dispose of it unless an exceptionally good piece is offered ; usually the price realised is far below the proper value.

When the trade was flourishing in this district several areas were enclosed for the growing of ash underwood, no doubt to meet the demand for hop-poles. One of these coves coming in for cutting in the year of 1903, I managed to dispose of it, at a very low price, having cut and cleared it early in the spring of 1904.

As underwood generally makes a very strong growth the first

year after cutting, this area is growing extremely well, and in examining the shoots some time in the same year I noticed how well some of them came from underneath the stool. I then cut all the shoots excepting the best back to the stool, doing this in several places in the area. Some months after, finding the selected ones were doing well, I had the whole area gone over, leaving one shoot on all stools, and always giving preference to the one coming from underneath.

Finding a few blank places where the underwood had failed, I had these filled up with 2—3 feet ash plants.

As this district suffers severely from spring frosts, it was found in the spring of 1905 that where nearly all the planted ash had been damaged by frost, not one from the stool had been touched, also that rabbits nibbled the planted ones but passed over the stool-shoots. As the stems or stools keep on shooting, trimming operations are necessary, but if this is done two or three times the first year the undesirable shoots are considerably weakened.

Having gone over my labour account carefully, I can estimate the cost of converting at 25s. per acre, that is, to trim all unnecessary rubbish, cut all shoots from the stems excepting one, and clear rubbish off ground. Taking this into consideration, with brushing over the whole area and planting up blanks, the cost may be anything from £10 to £15 per acre, including wire.

When one has a good crop of ash underwood on the ground it seems wrong that our predecessors' work should be abandoned.

I do not say that where one has very old underwood in hand this system would do, as the oftener the wood is cut the higher the shoots come from the stool. But where the wood has not been cut down more than four times I see nothing in the way of the system being carried out, and a good crop of timber obtained to take the place of underwood.

Probably, and correctly, the question will be asked, what quality of timber may be expected from this system? I fail to see, if the proper shoot is left, that there will be any deterioration in the quality. In planting ash several plants are sure to



ASH SAPLINGS FROM OLD COPPIE, STRATHFIELD SAYE.



die back, but come again, also some are sure to be eaten by rabbits, and some destroyed by spring frosts. These come again and are cut back to the stool. These cannot be seedling plants, no more than are stool-shoots in underwood. The largest and best trees on this estate were at one time cut back. Some of these I have felled, and although inclined to show black heart, which is common in ash, the quality otherwise is good.

The practice generally with owners of underwood is to go over their areas some time before cutting and mark with paint all saplings and standards. Occasionally a single ash pole is found which is marked to be left, yet if this were examined thoroughly it would be found that it had been cut down several times. How these single shoots, which have grown into poles, come to be single, is unknown to me. But from such as these have sprung the ash trees now standing in our old copses in the South of England, fine healthy trees, and from these I have taken my idea, and although only starting in the year 1904, I have some fine ash standing 14 feet high.

I have also tried the marking of one pole on each stem to be left when the area is cut over. If the crop is thick on the ground they are apt to be overdrawn and soon bend over. But where extra stout poles are found it is best to convert at once, as you have a growth of probably ten years to start with. In concluding these remarks I may add that if the old woodman had managed his high woods as he did his copses there would be no complaint about over-thinning. Let us then, as we have had to suffer over his mismanagement, repay ourselves by his good work.

W. R. BROWN,
Forester,
Strathfield Saye.

Official Papers.

NOTES ON THE FORESTRY EXHIBITION AT THE LINCOLN SHOW OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND. HELD JUNE 25th to 29th, 1907.

(FROM THE TRANSACTIONS OF THE R.S.A.S.)

THIS section was organised by the Royal Agricultural Society in conjunction with the Royal English Arboricultural Society, Mr. George Marshall, Mr. A. T. Gillanders, and Mr. W. B. Havelock being responsible.

This is the fourth time that such an exhibition has been held, and there can be no doubt that it was the largest, the most interesting, and the best educational display of British Forestry ever seen in England.

It was decided by the Royal Agricultural Society to offer this year special medals for boards, gates, creosoted fencing, examples of damage by insects, squirrels, voles, of abnormal growths, etc., in addition to the usual Exhibition classes of previous years. The result was most satisfactory, as there were numerous entries in nearly every class, hailing from Northumberland in the north to Kent and Wiltshire in the south.

The success of the Exhibition was largely due to the interest displayed in it by the President, the Earl of Yarborough, who contributed largely from his Lincolnshire estates.

The following is a list of the principal awards in the competition classes:—

CLASS I.—Specimens of oak, elm, and ash timber grown in Great Britain and Ireland, two boards, 6 feet long, of each.
(5 entries.)

Silver Medal: The Duke of Wellington, Strathfield Saye.

Forestry Exhibition at Lincoln Show. 117

Bronze Medal : The Marquis of Exeter, Burghley House.
Highly Commended : The Earl of Yarborough, Brocklesby Park.
These boards were very good indeed, particularly the English elm.

CLASS II.—Boards of larch, spruce, and Scots pine.
(4 entries.)

Silver Medal : The Earl of Carnarvon, High Clere Castle.
Bronze Medal : The Earl of Yarborough. The larch and Scots pine shown by Lord Carnarvon were perfect specimens of what such timber should be; the spruce was rather knotty, but sound and white.

CLASS III.—Boards of any other sorts of hardwood or broadleaved timber. (3 entries.)

Silver Medal : The Earl of Yarborough, who showed beautiful boards of Spanish chestnut, Wych elm, sycamore, hornbeam, lime, acacia, walnut, scarlet-oak, beech and plane. The lime, scarlet-oak, walnut and hornbeam were especially good, *Commended* : The Duke of Wellington, who sent beech, sycamore and Spanish chestnut.

CLASS IV.—Boards of any other coniferous timber.
(2 entries.)

Silver Medal : The Earl of Yarborough, who showed 7 kinds, including very fine cedar of Lebanon and Douglas fir. *Bronze Medal* : The Earl of Carnarvon, who sent Weymouth pine, silver-fir, and very fine Corsican pine, 2 feet wide.

CLASS V.—Specimens of insect pests injurious to forest trees.
(4 entries.)

Silver Medal : South-Eastern Agricultural College, Kent. This was really a museum in miniature, and well deserved the first place, but no forester could be expected to compete with the resources at the disposal of a college. *Bronze Medal* : Mr. A. T. Gillanders, Alnwick Park. Great credit is due to Mr. Gillanders for this valuable exhibit. *Commended* : The Earl

118 Forestry Exhibition at Lincoln Show.

of Yarborough. Damage by Tortrix moth (*Tortrix buoliana*) to Scots, Austrian and Corsican pines, with specimens of the insect in its three stages.

CLASS VI.—Specimens showing comparative quality of larch timber grown on different soils and situations. (1 entry.)

Silver Medal: Lord Burton, Burton-on-Trent, who was the only exhibitor. The difference in quality of timber from various soils was well marked.

CLASS VII.—Specimens showing comparative quality of any timber—other than larch—grown on different soils and situations. (No entry.)

CLASS VIII.—Specimens of pruning forest trees. (3 entries.)

Silver Medal: The Duke of Northumberland. *Commended*: Sir Montague A. R. Cholmeley, Bart. There were only three entries in this class, and, though interesting, they were not worthy of special mention.

CLASS IX.—Specimens of stems illustrating the effects of dense and thin crops in branch suppression and quality of the timber. (4 entries.)

Silver Medal: The Marquis of Exeter. *Highly Commended*: The Earl of Yarborough. *Commended*: The Duke of Northumberland. This was one of the most useful sections of the show, especially to persons interested in the growing of first-rate timber. The methods of the exhibitors varied, and it would be as well on a future occasion if some definite system could be decided upon. It is obviously difficult to show trees as they grow in a forest, as was done by the winner of the medal, who sent ash and larch trees 45 feet long. Lord Yarborough's exhibit comprised stems 6 feet long, and boards cut therefrom, of Austrian, Scots and Corsican pines, larch, Douglas, silver and spruce firs: and the difference between clean and coarse timber was well marked. The Duke of Northumberland sent Scots pine and spruce, in 4 feet lengths

from thin and dense crops, accompanied by valuable explanatory notes as to the number of trees per acre in each case, also the volume per acre from an unthinned crop 45 years old.

CLASS X.—Examples of the damage done by squirrels, voles, etc., and abnormal growths. (2 entries.)

Silver Medal: The Earl of Yarborough. This exhibit may be said to be unique, containing as it did specimens of fifteen kinds of witches' brooms, several of which have never been recorded before, and thirteen kinds of burrs. Many of the former, such as the broom on the elder, oak, and chestnut, are very rare. The burrs also were remarkable, especially the polished specimens from the oak and English elm. Trees and tree-tops of several kind damaged by voles and squirrels were also included, and a curious root-growth on the trunk of a beech, following damage done by fire to the bark.

CLASS XI.—Gate for farm or estate use, manufactured from oak timber, to be hung and shown in working order with fastening, unpainted. Prices, including the posts and ironwork, were attached to each gate, and are here given. (5 entries.)

Silver Medal: The Earl of Yarborough, 41s. 10d. *Bronze Medal*: The Marquis of Exeter 34s. *Highly Commended*: Sir A. R. Cholmeley, Bart., 35s. *Commended*: The Earl Fitzwilliam, 41s. The first prize gate was fitted—as were all Lord Yarborough's gates—with wooden swing-fasteners and wooden catches, and hung on good oak posts; the ironwork was simple, the top band clasping the top bar 18 inches, and the top crook reaching through the post with a nut at the back. If all persons who are responsible for the gates on estates had themselves to open them on horseback, there would soon be an end to all the various sorts of iron spring-fasteners so much in vogue. No fastener is so easily adjusted, and so easy to open on horseback, as the swing wooden ones so generally used in parts of Lincolnshire and Yorkshire. The Marquis of Exeter also showed a gate made of riven oak, which attracted much attention.

120 Forestry Exhibition at Lincoln Show.

CLASS XII.—Farm gate made from any other home-grown wood, unpainted. (6 entries.)

Silver Medal : The Earl of Yarborough, larch gate hung on creosoted spruce posts, 24s. 9d. *Bronze Medal* : The Marquis of Exeter, larch gate, 36s. *Highly Commended* : The Earl of Carnarvon, larch gate, 28s. The first prize gate was similar in design and fittings to the gate in the previous class, but a special feature was the creosoted spruce posts, which reduced the cost of the exhibit considerably, as well as showing the utilisation of comparatively worthless timber. The larch of which Lord Carnarvon's gate was made was of extra good quality, and without a knot. Some judges would have given it the second place.

CLASS XIII.—Wicket or hunting gate, self-closing, made of home-grown timber, to be hung and shown in working order, unpainted. (5 entries.)

Silver Medal : The Earl of Yarborough, Spanish chestnut gate on oak posts, 24s. 6d. *Highly Commended* : The Marquis of Exeter, larch gate, 29s.; the Duke of Wellington, folding hunting gate, 20s. (excluding posts). *Commended* : The Earl Fitzwilliam, larch gate on oak posts, 30s. 6d. The folding hunting gate shown by the Duke of Wellington was so arranged that the upper half, on drawing a handle, falls down against the lower part, and though forming no obstacle to huntsmen, the remaining half is sufficiently high to prevent rabbits getting into enclosed young plantations. It is a very ingenious arrangement, but rather too complicated to be serviceable.

Mr. W. Forbes, Shotwick Park, exhibited a so-called Hingeless Gate, 16s. 6d., but as a matter of fact it had hinges of a sort. The bottom of the back-head works on a coarse-threaded worm, which lifts up the gate as it opens, and the weight of the descending gate closes it again. It has a lift-up catch, which a rider would find rather difficult to open.

CLASS XIV.—Specimens of homegrown timber suitable for estate purposes, manufactured or otherwise, showing the

advantage of applying creosote or any other preservative.
(2 entries.)

Silver Medal: The Earl of Yarborough, who showed eight kinds of creosoted fencing used on the Brocklesby Park Estate, also creosoted spruce gate-posts, and creosoted larch and oak poles with branches 9 inches long left on for climbing plants. The last-named were shown with roses in full bloom and other climbing plants trained to them, and were most effective. If the posts are allowed to dry for a time before using, no harm is done to the plants by the creosote, and the life of the post is trebled. Lord Fitzwilliam, the only other exhibitor, showed some creosoted fencing made of Scots pine.

ARTICLES FOR EXHIBITION ONLY.

Mr. Fraser Story, of the University College of North Wales, Bangor, had a large exhibit, comprising planks, boards, and transverse sections of larch, Douglas fir, and *Thuya plicata (gigantea)*; hand-specimens of sixty different species of European woods, abnormal growths, damage done by squirrels to larch and birch, photographs demonstrating Continental forestry, specimens of damage done by various insects and diseases, etc., etc.

Included was a large well-hearted plank of Douglas fir, 2 feet across, showing rapid growth but coarse quality. It was grown on the Earl of Powis's estate, in a very thin wood, at an elevation of 1,000 feet.

The Earl of Yarborough showed a splendid collection of boards 7 feet long, of eighty different species, grown on his estates, with photo-micrographs of transverse sections, at a magnification of 10 diameters, showing structure of the timbers. These were much admired, as such a collection from one estate had not been attempted at any previous exhibition. Also hand-specimens of 167 different species of home-grown woods, all polished and labelled; forty-nine photographs of the Brocklesby Woods, illustrating the evolution of forestry from the nurseries, through the woods and back to the creosoting plant; lists of trees planted during the past 121 years, amounting to a total of 23,828,316 trees; particulars and

specimens of different tests, showing absorption of creosote oil by twenty-seven and fifty-six kinds respectively, of home-grown woods, in the round and in scantling, and the loss of weight in seasoning. Also samples of creosoted and uncreosoted fencing, which had been in use eleven years, on sandy, clayey, and chalky soils, demonstrating the remarkable preservative effect of creosote on spruce and other low-priced timbers. This part of the exhibit was most valuable to all owners of woods, demonstrating as it did the practicability of using at home for estate purposes all immature and rough timber, and selling only the best kinds. Included were also cast-iron date pillars for young plantations; galvanised number nails for driving into timbers, to fix the date of creosoting or erection; a selection of forestry tools, etc.

Messrs. Wm. Barron & Son, Elvaston Nurseries, had on view one of their tree-transplanting machines, which are now so well known.

Mr. W. Forbes, of Shotwick Park, exhibited a timber book, timber table, etc., which are useful to foresters.

Messrs. Richardson & Son, of Stamford, sent thirteen fine photographs (framed in brown oak) of some noted oak trees which they had sold, and the recorded prices of the same; and also a superb piece of brown oak veneer, highly polished, showing the grain of the timber to perfection.

A very interesting exhibit, to the younger generation, was that of Messrs. John Wisden & Co., London, showing six stages of the cricket-bat, from the rough willow-timber to the finished article.

A collection of willows, etc., suitable for basket-making, was sent by Sir Montague A. R. Cholmeley, Bart.

Mr. Geo. Marshall exhibited specimens of common and Japanese larches, which made out that the latter grew the quicker in its earlier stages.

Adjoining the exhibition, several of our leading nurserymen had large spaces planted with conifers and ornamental trees and shrubs. There has seldom been seen at any show a wider variety of plants, more tasteful grouping, and more striking and beautiful foliage. The chief exhibitors were Messrs. Little and Ballantyne, Carlisle; Messrs. Fisher, Son &

Sibray, Ltd., Sheffield; Messrs. James Backhouse & Son, Ltd., York; Messrs. Kent & Brydon, Darlington; and Messrs. Pennell & Sons, Lincoln.

It need only be added that the exhibition was worthy of the place and the occasion, and should awaken a greater interest in the cause of British forestry.

Thousands visited this section during the five days, and evinced an uncommon appreciation of it.

Professor Somerville, of Oxford University, acted as judge, and his decisions were received with practical unanimity.

Reviews and Notices of Books.

“HISTORY OF THE LUMBER INDUSTRY OF AMERICA.”

BY JAMES ELLIOTT DEFEBAUGH. 2nd Ed., Chicago, 1906-7.

THIS is a work which is difficult to review from our standpoint, because it contains an immense mass of information and statistics drawn from sources which are largely inaccessible to our readers on a subject which is little understood by the majority of English foresters. It commences with an account of the early settlement and primitive conditions of the lumber industry followed by a chapter on North American forest geography which is mainly taken from Sudworth and Sargent, and contains a short account of the principal timber trees of the United States and Canada. The next twenty-three chapters are devoted to British North America, giving the past and present conditions of the timber trade in Labrador, Newfoundland, Canada, New Brunswick, Nova Scotia, and Prince Edward's Island, with an account of the laws, production, prices, and particulars relating to this trade, which should be of great value to British timber merchants who wish to forecast the future, as well as to statesmen and traders in the Dominion itself. The forest reserves of the United States are treated of very fully, as well as the laws which have been passed

to regulate them. A very complete set of tables shows the rapid growth of the industry in each State, which seems to prove what has often been denied, namely, that the home consumption of timber is increasing so fast that a surplus for export cannot much longer be expected, at anything like the prices of the last few years. The second volume is occupied entirely with an account of the history and development of the industry in the New England States, amongst which Maine for many years took the lead as an exporting centre, though its most valuable production, *Pinus Strobus*, is now almost exhausted. There are many details of interest respecting the laws made in colonial times to protect and regulate the forests in the interest of the British navy. Fully half of the second volume is devoted to the great States of New York and Pennsylvania, whose forests were for a long period deemed to be inexhaustible, though they are now incapable of supplying local consumption. But several more volumes will be required if the Southern, Western, and Pacific States, which now furnish almost the whole of the timber for export, are to be treated of at anything like the same length. In this volume there are some good illustrations of notable trees, forest scenes, and pioneers of the lumber trade; but maps, which would have been of greater value to European readers, are wanting almost entirely. Considering the importance of having a correct idea of the extent of forest still remaining in the United States, we hope that Mr. Defebaugh, whose position as editor of *The American Lumberman* gives him exceptional advantages for obtaining the necessary information, will in later volumes supply this deficiency. The fine series of maps which were prepared by Professor Sargent for his report on the trees of North America some years ago, afford a good example of what is required, and with this addition we think the work will be found a most valuable book of reference by all who are in any way interested in this great industry.

H. J. E.

TREES AND THEIR LIFE-HISTORIES.”

By PERCY GROOM, M.A., D.Sc., O.C. Cassell & Co. Price 25s.

IT is a pleasure to welcome this sumptuous volume, with its wealth of beautiful illustrations from photographs by Mr. Henry Irving. The work occupies a place all its own in the English literature of trees hardy in this country, and its appearance must do much to stimulate an interest in our arboreal vegetation.

In a short introduction an account is given of the root, stem, leaf, flower, and fruit, and something is said about the nutrition of a tree and its adaptation to the environment. Thereafter the more important of our hardy British trees are individually discussed under the headings Gymnosperms and Dicotyledons. Most suggestive are the remarks on the comparative failure of Gymnosperms in the struggle for existence since Tertiary times, and on the interesting place occupied amongst existing species by *Ginkgo* and *Sequoia*.

Classification takes the form of dichotomous tables, the detailed systematic descriptions beginning with the conifers. The work is not an exhaustive treatise, but rather discusses types of the main groups. Of two-leaved pines the Scots, Corsican, Cluster, Bishops (*Pinus muricata*), and Stone pine receive detailed treatment, and then a five-leaved species, namely, Weymouth pine, is dealt with similarly. It would perhaps have been an advantage had an example of the three-leaved group been included, and north-country readers might not have objected to the substitution of *ponderosa* for *Pinea*. The European larch, common silver-fir and Norway spruce, are dealt with exhaustively by the aid of a beautiful series of illustrations, and if we have to be content with these as types of *Larix*, *Abies*, and *Picea* respectively, we must remember that even with such drastic exclusions the volume extends to over 400 pages. But just as we hinted that a three-leaved pine was perhaps worthy of a place, so we may be allowed to indulge in the suggestion of a regret that no place has been found for a flat-leaved spruce. One lingers lovingly amongst the beautiful pictures of the cedars, Douglas fir, marsh cypress, *Wellingtonia*, *Araucaria* and *Ginkgo*, and note is made of the

author's opinion that, however poisonous the foliage of the yew may be under certain circumstances, farm animals may "gradually accustom themselves to this diet." No other explanation seems possible when one observes with what impunity cattle and horses graze on many downs where the hedgerows and spinneys are full of yews; or on such an island as that in Loch Lomond, whose yew forest is said to date from the reign of an early Scottish king, who was concerned to protect his country by providing an adequate supply of bow-wood.

The dicotyledonous trees are treated on the same principle as the conifers, and the illustrations are equally abundant and beautiful. Of these, special mention may be made of the birch, catalpa, horse-chestnut and crab. In many cases the same individual tree is shown both in summer and winter, and from the same point of view. The characteristic differences between the English and Scotch elm, the sessile and pedunculate oak, and the three common maples are stated clearly, though it would have made for completeness had attention been called to the milky juice of *Acer platanoides*, whose English name, by the way, is misspelt, on page 283. This, and some little confusion as regards *Pinus insignis* (syn. *radiata*), on page 70, are the only slips that have been detected in a masterly work that reflects much credit on author, illustrator, and publisher.

W. S.

"INDIAN FOREST UTILISATION."*

THIS useful book is written primarily for the students of the Imperial Forest College, Dehra Dun. This college was formerly styled the Dehra Dun Forest School, and that name appears more suitable than the present one, as Dehra is extra-tropical and on the extreme north-west limit of the sal tree, the chief timber tree of North India, that here suffers considerably from frost and attains nothing like its full dimensions. The teak, which is the principal forest tree of the Indian Peninsula and of Burma, is not indigenous at Dehra, so that

* By R. S. Troup, F.C.H., I.F.S., Superintendent of Government Printing, India, 1907. Price 3s. 6d.

for these and other reasons India requires at least three superior forest schools, one in Burma and the other in South India, probably at Coimbatore, where there is already a well-established agricultural college.

Mr. Troup's book is adapted admirably for its purpose, and follows the usual lines of a manual on forest utilisation. First the technical properties of wood are described and illustrated by reference to those of Indian trees. It is stated the *Pinus longifolia* wood is heavier when grown in Sikkim than in North-West India, also that *Bombax malabaricum* is heaviest in the Central Provinces, and *Xylia dolabriformis*, ironwood, is heaviest in Burma. Mayer lays down a general rule that all species of trees produce the heaviest wood and grow best in their optimum climate, so that there is a fruitful study before the newly appointed Indian Forestry Research Officers to determine the optimum localities of the best Indian species of trees. As regards tensile strains, we read that suspension-bridges in the Punjab Himalayas are supported by the rough twigs of *Parrotia Jacquemontiana* twisted into ropes. The greatest transverse strength is possessed by the heaviest timbers, *Pterocarpus indicus*, *Xylia dolabriformis* and *Mesua ferrea*; the teak comes only in Class VI. of the strong timbers, and deodar in Class VII. There is a large proportion of *Leguminosæ* possessing great transverse strength. Teak, siscoo, and deodar, season well and with little warping or cracking, but some of the heaviest woods are liable to crack. The teak heads the list for durability, the other extremely durable trees being *Acacia catechu*, *Hardwickia binata*, *Xylia dolabriformis*, *Fagraea fragrans* and *Mesua ferrea*. Sal, deodar, *Cupressoo torulosa*, the michelias, satinwood, sundri, siscoo, padauk, and *Lagerstroemia Flos-Reginae* are all very durable. Owing to the presence everywhere of white ants durability is the most important quality of Indian timbers, and none of the 31 Indian oaks are very durable, the species *dilatata*, *serrata* and *lamellosa* being the best.

The chapter on the uses of timber is very well written, and there is a long section on railway-sleepers, for which it appears that chiefly teak, deodar, sal and ironwood are used; soon four millions of sleepers will be required annually for the Indian railways, although many of the lines are laid with metal

sleepers. These latter give a rough running road and cause greater wear-and-tear; they are also responsible for more accidents than wooden sleepers.

The author states that the wood of *Juniperus recurva* is probably equal to that of *J. virginiana* for lead-pencils, but the quantity of it available is small. The manufacture of wooden combs is an important industry in India, the wood used being fine-grained. A number of woods, including boxwood, are employed for this purpose.

The chapter on felling and conversion of wood follows the lines of European manuals on the subject. There is not usually a sufficiently large or steady supply of water to drive sawmills, and the abundance of wood-fuel renders steam-power cheap.

Sledge-roads within gradient limits of 4 degrees and 11 degrees are used in the North-West Himalayas, and reduce the cost of carriage formerly done by coolies in the ratio of 1 to 4 and even 1 to 7. Wet slides, in which the best gradient is 15 degrees, but may go up to 25 degrees, also are used commonly and give most satisfactory results, the steeper the slide, the less water being required. Forest-tramways are used in Assam and in the Punjab, but this is not stated by the author, though references to the actual use of all the means of transport described are useful. Wire-tramways do not appear to have been hitherto successful in forest transport.

A whole chapter is devoted to grass, which is a very important Indian forest-product, and it is said that by ploughing, weeding out coarse varieties of grass and other weeds, and manuring, the grass farms at Allahabad now yield five or six crops yearly on land that was formerly barren. Ensilage appears to be freely used. The question of tans and dyes, gums and distilled oils, is dealt with in an interesting manner. *Acacia Senegal*, which grows in Sind, the Punjab and Rajputana, as well as in Africa, yields true gum arabic, but in India is so often mixed in the other gums as to be less valuable commercially than African gum.

Resin-tapping is now carried on in the Himalayas on the French method, from *Pinus longifolia* trees, each tree yielding from 5 to 12 lbs. of crude resin annually. Caoutchouc from

Ficus elastica in Assam, where there are extensive State plantations of the tree, can be obtained at the rate of 10 lbs. per tree; for trees fifty years old the cost of making the plantations is put at £3 per acre, and that of harvesting and preparing the caoutchouc at 6*1/2*d. to 7d. a pound.

Interesting accounts are given of lac, wild silk, hunting, fishing and elephant-catching, the manufactures of cutch, turpentine, and rosin, and the book terminates with a description of the antiseptic injection of timber. There are a number of plates at the end of the book, the one defect of which is, that the plates are not put alongside the text which they illustrate. We hope that this may be done in the next edition, and that this may occur very soon, for Mr. Troup is to be congratulated on the style and matter of this excellent manual.

ENCYCLOPÆDIA OF AGRICULTURE.

“FORESTRY,” BY THE RIGHT HON. SIR H. MAXWELL, BART.

SIR HERBERT MAXWELL has written a most interesting account of forestry for the Encyclopædia of Agriculture. He lays down that the cardinal principle of forestry is continuity, as the rotation of trees, unlike that of agricultural crops, is measured not by men, but by generations of men. This principle has never been acted on in the United Kingdom, owing to our coalfields and the peat in Ireland rendering us more or less independent of wood-fuel, while landowners have preferred the quick returns of agriculture to the slower returns from woodland. Owing also to the building of iron ships, the price of oakwood has gone down, but the enormous development of manufactures and the consequent demands for building-material have now caused an immense demand, chiefly for coniferous timber, and the increased imports of timber have gone up from £13,695,297 in 1886 to £26,033,647 in 1905, *i.e.*, by 90 per cent.

To show that home-timber is at present saleable at remunerative prices, those given in our last year's April number are quoted, and the author states that the demands for oak, ash, larch, and sycamore of good size seem to exceed the supply,

while good beech and elm are in request. There can be no doubt that this is true for the Midlands and the North, especially for Scotland, but prices are still low in Ireland, and railway charges are so high that proximity to a good timber-market is essential if woodlands are to pay.

The writer advocates State forestry for our waste lands, the plantable area of which he assumes from Nisbet ("The Forester," i., 95) at 3,340,000 acres, which excludes all land over 1,000 feet above sea-level and all bog and wet land. Private landowners, even with the best intentions, can seldom afford the necessary lock-up of capital during the unremunerative early years of a woodland, while the State pays no death-duties.

The question of planting by municipalities is also referred to, and the plantations of the Liverpool waterworks. Also those of Birmingham, Leeds, Manchester, and Edinburgh might have been mentioned. Among private woodlands those of Novar, in Ross-shire, are cited, the balance-sheets of which, after debiting working expenses, grazing rent, fire-insurance, etc., show an annual net-revenue of 11s. 1d. per acre for 3,670 acres, almost exactly corresponding to the revenue earned by German State forests, though that of silver-fir forests in the Vosges Mountains is £2. At Novar, planting and clearing have been continued on a regular system from 1800 to 1850, but were interrupted from 1850 to 1881, when Mr. Munro Ferguson, M.P., the present proprietor, resumed the continuity of working. This woodland is not unique in this respect, as Sir H. Maxwell states, for Lord Yarborough's woods in Lincolnshire, 5,000 acres, have taken 100 years to plant and are now being cleared and replanted at the rate of 50 acres annually. When shall we have a history published of these very interesting woodlands?

There is a good account of nursery work and planting, the German planting-stick, of which a plate is given, being recommended, though Schlich's vertical planting-spade is better for small plants. The writer concludes that on the whole pit-planting is preferable to notching, though the cheapness of the latter will always cause it to be chosen where herbage is not too strong.

Natural regeneration is regarded only as a more or less accidental process in the United Kingdom, chiefly owing to the prevalence of rabbits. After all, rabbits can be exterminated, and natural regeneration has been followed from time immemorial in the Chiltern Hills beechwoods, and is also most successful in the pine-woods of the Duke of Bedford at Woburn. The enormous gain by this to the proprietor in initial expenditure is not considered sufficiently in Britain.

Schlisch's tables are quoted as affording a guide in estimating the prospective of woodlands, and A. C. Forbes' estimates are also referred to, but it is said that Schlisch's estimates include much small timber which, though saleable on the Continent, is not so in Britain. Drastic thinnings, which are still prevalent in almost all parts of the country, ensure the ruin of woodlands for almost every purpose, except game-covers and shelter.

An important quotation from Mr. A. C. Forbes ("English Estate Forestry," p. 195) is given:—"If the woodland proprietors of a certain district could agree to work their woods as a whole instead of as distinct units on each estate they could command the market to a much greater extent than is the case now. Hardly a sale takes place at which some agreement among buyers is not arrived at by which one is prevented from bidding against another. But one rarely hears of a counter-agreement amongst timber-sellers to prevent the market from being over-stocked."

Pages 658 to 725 are occupied with a most interesting account of the species of trees grown in Britain, but unfortunately we have not space to review this part in detail, and will merely point out a few interesting points. Sitka spruce is said to be more hardy than Norway spruce against cold winds, less particular as to soil, of very rapid growth, and should be grown in Britain in preference to Norway spruce. *Abies Nordmanniana* escapes damage from spring frosts, but when between twenty and thirty years old succumbs to attacks of aphides. *Abies grandis* is not attacked by aphides, but its timber is said to be inferior. Douglas fir cones at Durris, Deeside, are now so attacked by *Megastigmus spermatophorus*, one of the *Chalcididae*, usually believed to be parasitic on insects, that the cones, of

which formerly 300 bushels used to be collected in good seasons, are now not worth harvesting. There are a few doubtful, or erroneous, statements. Thus, on p. 663, it is said that no *Abies* except the common silver-fir will stand shade. This is certainly not the case in India with *Abies Pindrow*. On p. 666 it is said that Mr. Crozier used to collect 300 bushels of Douglas fir seed in good seasons at Durris on Deeside; this should be *cones* and not *seed*. Page 667, the Californian spruce should read the Western hemlock (*Tsuga*). Is there any foundation for the story that the fine larches at Dunkeld were thrown on a rubbish heap by the Duke of Atholl's gardener in 1827? *Pseudo-Larix Kampferi* may be hardy in warm situations, but, as a rule, does not thrive in Britain. The large Ginkgo tree has disappeared from Melbury. There is no evidence of the lime-tree being native in South England, but lime timber was formerly very valuable, and is still worth more than many other species. Mr. R. Anderson lately sold one in Gloucestershire at 4s. a cubic foot.

MITTHEILUNGEN DER DEUTSCHEN DENDROLOGISCHEN GESELLSCHAFT, 1907. .

THIS volume, just issued, is the largest and most interesting ever published by the German Arboricultural Society, and is full of articles of great importance to English lovers of trees. The society now numbers no less than 1,540 members, as compared with 1,150 only a year ago; and it is evident that if the activity of German landowners, foresters, and professors, in planting and studying exotic trees continues as at present, the time will come when Great Britain will no longer hold the first place for the abundance of its exotic trees. Under the presidency of Count Fritz von Schwerin, himself a very active and learned arboriculturist, the society is evidently prospering in a remarkable way, and is aided by a State subvention of £225, which seems to be spent to the very best advantage.

The volume commences with an account of the annual excursion to North Germany, Sweden, and Denmark, by Herr

Beissner, the well-known authority on coniferæ, who is editor of the society's journal.

A most interesting article, by Count von Wilamowitz, on the results of 35 years' experiments on the planting of exotic trees at Gadow, in the Province of Brandenburg, is of great value to us, because the climate of this place seems much more like that of some parts of Scotland and Ireland, though colder in winter and warmer in summer, than that of central and southern Germany. There are also articles of great interest by the veteran John Booth, who for so many years has encouraged the cultivation of exotic trees in Germany, and who is now able to see the success of his efforts in many places. An article by Forstmeister Rebmann, of Strassburg, on *Juglans regia* and *Juglans nigra*, shows with German exactitude and much detail the great value of the black walnut as a forest tree in the district he writes of, and fully bears out all the favourable opinions of this tree which I have expressed in our own work.* Of the financial result of planting this tree under suitable conditions, Rebmann's estimate is extraordinary. He reckons the total value of a hectare (= 2·47 acres) of black walnut in 100 years at 88·94 marks = £4 8s. 10d., the timber being valued at £10 per festmeter (= 35·1 cubic feet) (?), whilst that of oak he puts at only 10·46 marks, and of ash at 14·2 marks.

Even if we allow only half the price he gives for the timber, the results are far beyond anything that our most sanguine expectations have reached; and if I was lucky enough to own deep rich alluvial sandy loam in Kent, Surrey, or the Thames Valley, where this tree grows to the greatest perfection in England, I should not hesitate to plant a few acres of it with black walnut, even if I had to take land worth £3 per acre. And yet, so far as I know, no proprietor has yet recognised the superlative value of this noble tree, which is disappearing rapidly from the forests of America.

If space allows the above-mentioned article should be translated for our journal.

H. J. ELWES.

* "Trees of Great Britain," p. 265.

LIST OF BOOKS RECEIVED OR NOTED.

“Report on the Injurious Insects and Other Animals in the Midland Counties during 1907,” by W. E. Collinge. Birmingham: Cornish Bros., 2s. 6d.

“Wood,” 2nd ed., by G. S. Boulger. London: E. Arnold, 1908.

“Trees of Great Britain and Ireland,” Vol. III., by H. J. Elwes and A. Henry, has just been published.

It is hoped to review these books in the July number of this journal.

Current Topics and Short Notes.

THE Departmental Committee on Irish Forestry met in London on the 25th February, to discuss and revise their draft report. Their final meeting to sign the report will be held in Dublin, on the 2nd April.

The following committee has been nominated by the Secretary of State for India “to enquire into and report upon the present system of selecting, and of training after selection, candidates for the Indian Forestry Service, and to make recommendations”:

Mr. R. C. Munro-Ferguson, M.P. (Chairman), Sir John Edge, K.C., Member of the Council of India, Sir W. Thiselton Dyer, K.C.M.G., C.I.E., F.R.S., Mr. E. Stafford Howard, C.B., Commissioner of Woods and Forests, Mr. St. H. Eardley-Wilmot, C.I.E., Inspector-General of Forests in India.

This committee commenced taking evidence on the 18th March, Professor Schlich, Mr. J. Sykes Gamble, Mr. E. Popert, Mr. W. R. Fisher, Colonel Pearson, Mr. A. G. Hobart Hampden, the Vice-Chancellor of the University of Oxford, Mr. Bidder, of St. John’s College, Oxford, having been examined. Many other witnesses will be called, and the report of the committee will not be published for some time, as reference may have to be made to the Government of India.

Professor Somerville gave a lecture at Carpenters' Hall, on "Trees, New and Old," on 19th March.

Publications of the United States Department of Agriculture.

The following pamphlets have been received:—Consumption in 1906 of Poles; Cross-ties (Railway-sleepers); Pulpwood, Tan, &c.; Drain on Forests, by R. S. Kellogg; Forest Tables, Lodge-pole Pine, Western Yellow Pine; Forest-planting in Illinois; Forestry in a Spruce Tract in Maine; The Forest Service, and how it deals with Forest Problems; Forestry in Public Schools; Lumber Cut of the United States, 1906; Management of Second Growth in S. Appalachians; Preservation of Piles against Marine Wood-borers; Preservative Treatment of Fence Posts; Production, in 1906, of Veneer, of Tight Cooperage Stock; Seasoning of Telephone and Telegraph Posts; of Hemlock and Tamac Cross-ties; of Arbor-vitæ Poles; Suggestions for the Disposal of British Timber Supply of the United States; The S. Appalachian and White Mountain Watersheds: advisability and cost of purchase of the forests by the State; What Forestry has done; Wood used for distillation in 1906.

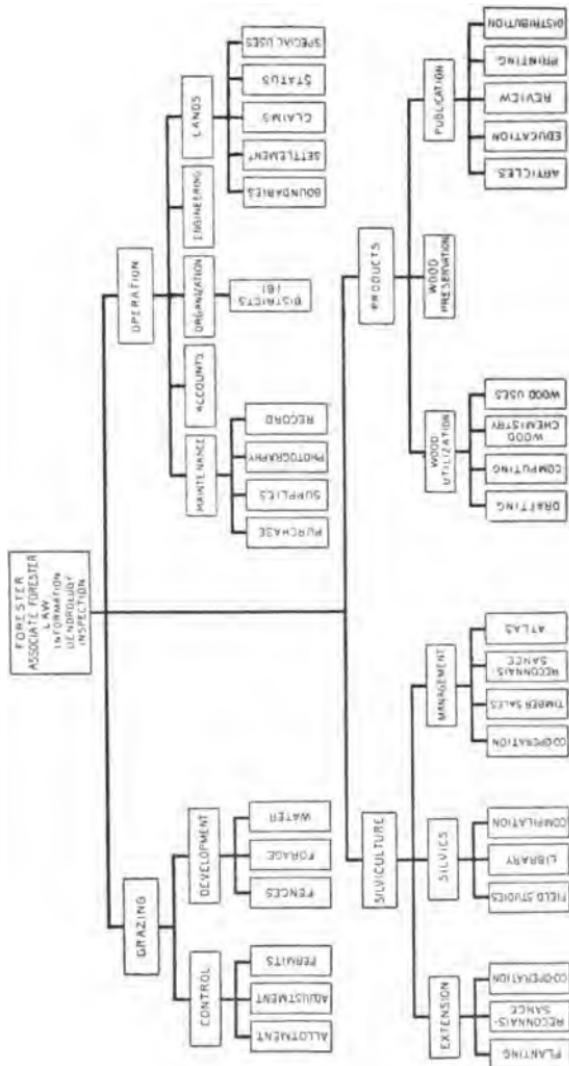
It is useless to attempt to give notices of all these valuable pamphlets, which can be obtained on application to the Government Printing Office, Washington. A few notes will, however, be given.

The annual output of the forests is given as follows:—

			Value in Million Dollars.
Lumber, board feet	...	35,000,000,000	560
Firewood, cords	...	100,000,000	350
Shingles and laths	...	100,000,000	30
Hewed cross-ties	...	70,000,000	30
Cooperage stock	...		25
Turpentine and rosin	...		25
Pulp-wood, cords	...	3,000,000	15
Logs exported	...		10
Mine timber	...		30
			<hr/>
		Total 1,075	
		millions of dollars = £215,000,000	

136 Current Topics and Short Notes.

The total quantity of wood cut to obtain these products was not less than 20 billion cubic feet.



The Report of the Forester for 1907, dated January 30th, 1908, by G. Pinchot, deserves a more lengthy notice.

The salient features of the year are: a radical change of organization, so as to secure better control. The present organization of the Forestry Department can be seen from the diagram on the previous page.

The national forests have been increased from 167,188 to 234,375 square miles, all under organized administration. The control of forest grazing has been improved greatly. There are over a million cattle and horses and over six and a half million sheep in the national forests in summer and about 200,000 of the former throughout the year. Protective measures against fire were highly effective; the area burned in 1906 was less than 7.7 acres in 1,000, having been twenty-six acres in 1,000 in 1905. The planting done is comparatively small, 418,850 plants only in the national forests. Forest planting by private owners under advice of the Department increased largely during the year, and twenty-three working-plans prepared for private owners on 19,600 acres.

In order to render the national forests more accessible, the following work is planned for 1908: 3,500 miles of telephone lines, 3,000 miles of trail, 200 miles of road, 250 bridges, 500 miles of fences, 500 cabins. A wild bison pasture has been established in Oklahoma, and a herd of fifteen American pure-bred bison will be placed under the local forest officer. Two new forest species have been discovered: a brown-wooded New Mexico juniper (*Juniperus megalocarpa*, Sudio) and a Californian oak (*Quercus Pricei*, Sudio). A special section of the Department, that of the "Forest Atlas," to secure good maps of the forests, has been organized. Much experimental work has been done, chiefly on mechanical tests, the preservation of timber and improvement of resin-tapping. As regards damage by forest insects, the Black Hills beetle alone is referred to, and it has been shown that this insect can be controlled.

Part I. of the four books planned to cover the forest flora of the United States was completed. It describes 152 forest tree species of the Pacific slope and is designed as a manual for national forest officers. Part II., "Forest Trees of the Rocky Mountains," is in hand. Sixty-one pamphlets, with two million copies, have been issued; the mailing list of persons to whom descriptive notices of these are issued containing 693,000 names.

We congratulate Mr. Pinchot, the director of the vast organization, on the progress made by his Department in 1907, and also that his salary has been raised to the modest amount of 5,000 dollars—£1,000. Mr. Pinchot's circular on the Black Walnut is given below.

A pamphlet by Professor H. Mayr, on the variations of forest plants and their practical importance, will be noticed at length in the July number. Notes also will then be given of the numbers of "The Indian Forester," from January to May, some of which have been received.

BLACK WALNUT (*Juglans nigra*).* *Form and Size.*
When grown in the open the black walnut is a rather symmetrical tree, with a massive crown, short trunk, and a form similar to that of open-grown oaks and chestnuts. In the forest the trunk lengthens into a tall, tapering column, often with no limbs for a distance of 50 or 60 feet, and surmounted by a much reduced crown. The foliage is thin, and never completely shades the ground. On the lower mountain slopes of the Carolinas a height of 110 feet and a diameter of from 5 to 6 feet is often attained. The usual height of the mature forest-grown tree is from 70 to 90 feet, and the diameter from 30 to 45 inches. Trunks of low, spreading trees in the open often measure over 6 feet in diameter.

Range. Black walnut is one of the most widely distributed and valuable of our deciduous trees. In nature it grows sparingly from south-western New England westward, through New York, Ontario, Michigan, and Wisconsin, to southern Minnesota, thence southward, with central Nebraska and Kansas as the western limit, to south central Texas and Florida. It does not appear along the Gulf or the South Atlantic seaboard, and is much more abundant in the Central than in the Eastern States.

* United States Department of Agriculture, Forest Service, Circular 88, Gifford Pinchot, Forester.

Although of fair size wherever found, black walnut attains its best development in the deep hollows of the western slope of the southern Alleghanies, on the rich bottom lands along the Mississippi and Ohio rivers, and in Arkansas, Missouri, eastern Nebraska, Kansas, and Indian Territory. In the mountains of the Carolinas and Tennessee it occurs in mixture with oaks and chestnut, while in the original hardwood forests in the river valleys of Ohio, Indiana, Illinois, and Kentucky it is found associated with the maples, hickories, oaks, basswood, cherry, and other hardwoods of the region, though not always intermingling closely with them. West of the Mississippi the walnut is confined to river valleys and moist situations. In this western region it is found associated with the coffee-tree, green ash, hackberry, basswood, and white elm.

The walnut is nowhere a gregarious tree, but usually occurs in scattered groups or as isolated individuals among other species. Within the limits of its range there are regions where it is almost unknown, while within a few miles it may be common, though conditions in both localities seem identical.

The natural range has been increased both to the east and west by planting. In Rhode Island, eastern Massachusetts, and southern New Hampshire and Maine the tree was probably not native, but has been planted in small quantities for its nuts, and grows well. In Iowa and eastern Nebraska plantations of black walnut have been successfully made. Plantations have been made as far west as Salt Lake City, southern Idaho, and throughout California, with evident success. In California the black walnut has been planted to a very limited extent for timber, to a greater extent for ornament and the yield of nuts. In the San Joaquin and Sacramento valleys the California black walnut, native to the southern part of the State, has been grown successfully instead of the eastern black walnut.

Habits and Growth. The ideal conditions for growth are found in the rich, moist soil of bottom lands or on fertile hillsides which are protected from cold, sweeping winds. A calcareous soil or a sandy loam, containing a large quantity of humus, overlying a deep subsoil of gravel and a water table in which the long taproots can find a continual supply of moisture,

furnishes the best conditions for growth. The surface soil should be moist, but not wet, and the subsoil porous.

While not especially adapted to widely varying conditions, the black walnut will grow in many localities outside of its natural range; but its form and rate of growth are appreciably affected by its environment. Throughout the entire Middle West south of the forty-fifth parallel, planting on limited areas may be attempted with fair prospects of success on all fertile prairie land, and especially in coves, valleys, and extensive bottom lands where the requisite moisture is present and partial protection from the wind can be had. This latter requirement may be secured by starting the plantation in the lee of a natural wind-break or by planting a shelter belt of hardy, rapid-growing species on the exposed sides. The most favourable range for economic planting is in the fertile valleys of the Ohio and Mississippi rivers and their tributaries and on the bottom lands of the Carolinas, Georgia, Tennessee, Kentucky, Missouri, eastern Nebraska, Kansas, and Oklahoma. On upland soils, especially in the West, where there is a stiff subsoil, the species makes slow growth. In the south-western plains the dry, hot weather of summer is often injurious, while in Minnesota and the Dakotas the cold of winter often kills back the season's shoots.

The black walnut is intolerant of shade. The foliage of a walnut plantation is thin, seldom shading the ground to such an extent as to prevent the growth of grass and weeds.

In good soil the rate of growth is fairly rapid and is continued up to mature age. In the best situations planted trees occasionally make a diameter growth of nearly an inch each year, but under average conditions an increase of one-fourth to one-third inch is all that may be expected. A tree twelve to fifteen years old will begin to bear fruit, and lumber will be produced in forty to sixty years. Along the northern limit of its range it is somewhat susceptible to sun scald, and should be protected from the wind and sun by hardier species.

Economic Uses.—The wood of walnut is heavy, hard, strong, and of coarse texture. The sapwood is narrow and whitish in colour, and the heartwood is a chocolate brown, which deepens with age and exposure. The wood shrinks moderately in

drying, and if care is taken dries without checking. It works and stands well, takes a good polish, and is valuable as a cabinet wood. It is very durable in contact with the soil, as only the sapwood decays.

Walnut was formerly much used for furniture and interior finish, especially in churches; in cabinet work, for gunstocks, tool handles, and carriage hubs, and to some extent in the construction of ships. Formerly more abundant, it was used for fence posts and made into shingles. At present the market is much better in Europe than at home, and large amounts are exported in the form of logs 10 to 20 feet long and 15 to 30 inches square. However, 30,000,000 feet B. M. of walnut were sawn in this country during the year 1905.

The price of walnut lumber is little, if at all, higher than it was twenty-five years ago; about \$100 per thousand is paid for the best grades and \$50 to \$70 for medium grades. The average value of the lumber manufactured in 1900, as given by the last census, was \$37 per thousand. Logs of unusually fine grain sometimes bring high prices for veneer manufacturing.

The greatest returns will be realised from this species when it is planted with a view to growing saw timber. If a walnut plantation is established for this purpose it is advisable to underplant with some tolerant tree that may be cut with profit in twenty or twenty-five years, leaving the walnut as the permanent stand until merchantable size is attained. As this will require a period of about seventy-five years, extensive walnut plantations are not advisable unless a long-time investment is sought.

Methods of Propagation.—Under natural forest conditions the black walnut does not reproduce readily, and becomes almost extinct wherever lumbered clear. The tree does not reproduce from suckers and only sparingly from stump sprouts; squirrels usually destroy many of the fallen nuts, and young trees are killed by dense shade.

The nuts may be stored over winter by stratifying them in moist sand or leaves in a sheltered place out of doors. In stratifying 3-inch layers of sand should alternate with single layers of nuts. Boards should be placed around the edge of this store

of nuts and the top protected against burrowing rodents. The sand should be kept moist, and the whole mass allowed to freeze.

For extensive and satisfactory propagation of the species, artificial sowing is the only sure method. Because of the long taproots and consequent difficulty in transplanting, nursery culture is in general not advisable. It can, however, be made successful if root pruning is practised and great care taken in moving the plants. Nursery culture, if attempted, should be conducted as follows:—

The nuts should be planted at 6-inch intervals in nursery rows 3 feet apart, and covered 1 to $1\frac{1}{2}$ inches deep. A preliminary freezing of the nuts will be beneficial rather than injurious. The plants in one year should attain a height of 12 to 14 inches, and may be transplanted to the permanent site in the spring when one year old.

Planting.—The plants may be set in furrows, or in holes dug with a spade, care being taken to keep the roots from drying out, and to pack the earth firmly around them. In general the better plan is to omit nursery culture altogether and sow the nuts in their permanent place in the plantation. Either fall or spring planting may be practised, but spring planting is usually best.

In the East a furrow or a series of holes the proper distance apart will be sufficient for the reception of the seeds. On the plains and prairies of the West, greater care in preparing the soil is essential. The sod should be broken, and the ground put in corn or some other common crop for one or two years. The nuts may then be planted in the spring in shallow furrows and covered with a plough to a depth of two or three inches and the ground well firmed down. The rows should be straight in at least one direction, to facilitate cultivation. The spacing will vary in different localities. An interval of 6 or 8 feet apart each way is recommended.

Since the black walnut is a long-lived, light-demanding tree, it may with advantage be combined in the plantation with a more heavily-foliaged species. The associate trees should be allowed to grow until they clear the lower limbs from the walnut and stimulate it to a rapid upward growth,

when they should be removed and the long-lived species left to finish its growth alone. Desirable trees for such a mixture are the hardy catalpa, hackberry, Osage orange, and box elder. When the walnut and other species are thus combined, the walnut should be given two or three years' start in order that it may not be overtapped.

Cultivation and Care.—The plantation should be cultivated until the tops of the trees meet. During the first three years corn may be grown between the rows to give additional returns from the soil.

SALES OF TIMBER.

Ireland.—Scarcely has the Irish timber trade recovered from the glut caused by the heavy storm of 1903, than it has again to face overstocking of the markets brought about as a result of the Irish Land Act of the same year. Plantations are in many instances included in the sale of lands to tenants, who place them in the market at once, and sell at a very cheap rate, as they are ignorant of the value of timber. Landowners, who have reserved their woods, or have not so far sold to tenants, find, as a consequence, that in the present state of the markets good prices cannot be obtained for timber in the round state. In the west of Ireland the usual method of selling large lots of trees is to mark, stamp, and number each tree; cataloguing number, kind, cubic contents (approximate), price per cubic foot, and value of each tree. When this is done, in book form, the lot is advertised; and several English timber merchants, who annually visit Ireland, are notified, in the hope that they will think it worth while to come to tender for the timber as a standing lot. If the timber offered for sale does not contain a large percentage of heavy clean ash and sycamore, offers will be few and scanty.

The purchaser, as a rule, contracts the felling, cross-cutting, and loading in waggons, to some local man; who nearly always employs inexperienced labour, which adds considerably to the cost of working, and so has to be taken into account as

a materially reducing factor in calculating the original price offered; while the fact that the conditions of sale have to be more detailed, and made much more stringent than in England or Scotland, also tends to further hamper the purchaser.

Then the troubles begin, as gates are broken, fences damaged, and the theft of unsold timber is not uncommon if convenient to the purchased lot. In fact, the forester has, to a certain extent, to look after the interests of the timber merchant, as well as those of the proprietor, in order to see fair play, or the whole business would soon be at a standstill. One would think naturally that the purchaser would supply a man to take charge of operations, but when this is done, the man has to work out several lots, and so is not on the ground for any length of time at once.

The last lot sold here (1906) weighed 1,200 tons; and contained 825 trees, viz.:—245 ash, 303 oak, 43 elm, 136 beech, 26 sycamore, and 72 various. The approximate price realised per cubic foot, tape over bark, was as follows:—

Kind of Tree.	Price per cubic foot.	Kind of Tree.	Price per cubic foot.
	s. d.		s. d.
ASH.		SYCAMORE.	
Good quality, clean butts, 14 in. and over quarter girth ...	0 8	All light... ...	0 6
Rough butts and heavy limbs	0 5	OAK.	
Tops	0 2	Large, clean, heavy butts, to be 25 ft. of clean bole, and 14 in. quarter girth ...	1 0
		Light butts	0 6
BEECH.		ELM.	
Butts, all rough ...	0 4	All rough	4d. to 6d.
Bobbin wood ...	0 2		

The trees in the foregoing lot were not very heavy, and the ash were very short in the bole. Some of the oaks were good, with long clean boles. The purchaser felled, crosscut, and carted them to the station, a distance of 4 miles. We are 29 miles from the nearest seaport by rail. Scots fir and spruce are of practically no value in a lot similar to the above, but as

we have an estate sawmill running daily on commercial lines, we can sell sawn timber of this class to advantage, as well as use it on the estate. The local demand is so heavy that we cannot meet it, although we have two benches in use almost daily. As our timber is approved by the Estates Commission, and the Congested Districts Board, which practically secures for us all the trade in the neighbourhood, we can well hold our own with the local traders who have only foreign timber to offer. We now realise a handsome profit on what would be valueless without a sawmill. Ash, oak, and elm have similarly increased in value, when offered in the sawn state. With a band-sawing machine we cut felloes for wheel-making, and do a considerable business in that particular line. Mr. McKendrick, head forester to the Earl of Westmeath, tells me, that with them, the estate sawmill pays much better than selling large lots in the round for export, and I think this is general in the west of Ireland. The acreage under woods in Ireland is steadily decreasing, and likely to do so, as, at the present moment, all timber merchants are busy, large quantities of timber having been placed on the market, chiefly due to the Land Act of 1903.

ALEX. LITTLE.

CASTLE MACGARRETT ESTATE,
CLAREMORRIS.

East Sussex.—The sales of timber in East Sussex for the past year have been slow. There has been no special demand for any particular type of timber, except perhaps quite small larch, from sizes suitable for rustic work, to trees that will split for fencing. The demand for oak, which is by far the chief timber grown, has been much the same as in the two previous years, and the prices regulated more by the suitability of the trees for cleaving purposes than by their cubic contents. The type of oak consequently more particularly in demand is a long, clean stem, and trees over 18 feet without a branch have a special value.

The following prices will give some idea of the market :—

			s. d. s. d.
OAK.—Up to 10 feet	...	...	1 0 to 1 4
10 to 20 feet, according to straightness	...	...	1 3 " 1 6
Over 20 feet	...	...	1 6 " 1 9
			Parcels of good, straight and sound timber have fetched 1s. 9d. all round, but 1s. 6d. to 1s. 8d. has been a more general price.
ASH.—Up to 10 feet	...	...	1 0 " 1 6
10 to 20 feet	...	...	1 3 " 1 8
Over 20 feet	...	...	1 6 " 2 0
			Parcels of ash timber will fetch prices a trifle in advance of oak.
ELM	...	...	0 5 " 0 9
BEECH (good)	...	...	0 6 " 0 9
SWEET CHESTNUT (if sound)	...	...	0 8 " 1 0
SCOTS FIR	...	...	0 3 " 0 6
LARCH	...	...	0 10 " 1 0

These prices relate to timber which is generally within two or three miles of a station, with fairly good carriage.

The timber is measured, when standing, with a strap ; and, if felled, with a string doubled. An allowance of 1 inch in 12 inches, quarter girth, is made for all rough-barked trees, but with beech and larch a more usual allowance is 10 per cent. on the cubic contents, subject somewhat to arrangement. The main stem and one branch are included in the measurements.

The sale for underwood has been bad. Hazel from old stools has no value at all, and the best hazel of 12 years' growth, close to good roads, is not worth more than £2 per acre. There has been a slightly increased demand for chestnut underwood owing to the trade in economic fencing. Pure chestnut underwood of 8 to 12 years' growth has fetched up to £4 or £5 per acre. In the hop districts, where poles of 20 years' growth are large enough for straining posts for wire-work, some few lots have realised £10 per acre and even more.

J. P. ROBERTSON.

West Sussex.—All the timber offered during the present season has met with a ready market, and the prices obtained have been slightly better than last year.

The price per cubic foot is for timber felled and boughed, lying in the wood, measured by string, with an allowance of $\frac{1}{8}$

of the girth for bark. Except in the case of hedgerow timber, the butts only are measured.

The beech timber is mostly of a size suitable for chair-making, and we sell about 300 trees annually to a turner, who works the smaller timber into chair legs and spindles in the woods.

The following prices have been obtained this season :—

Description.	Quality.	Price per cubic foot.	Remarks.
		s. d. s. d.	
Beech ...	Good	0 7 to 0 8½	3 miles from station. Rough road.
Ash ...	"	1 3 " 1 6	Good road.
Oak ...	"	1 6 " 1 9	"
" ...	Small	1 2 " 1 4	Rough road.
Elm ...	Good	0 10½	Good road.
" ...	Tops	0 6	"
Sycamore .	Small	1 0	Within a " mile of station. "
Larch ...	Good	0 10	6 miles from station. Good road.
" poles	"	(each) 1 9	6
Scots Pine .	"	0 5	Within a " mile of station. "
Spruce ...	"	0 5 to 0 5	" " "

The beech and ash are long and clean grown, being about 40 feet in length, with an average quarter girth of about 10 inches.

The oak is mostly coppice grown, short in the butt, but of good quality.

ALEX A. MYLES.

WEST DEAN ESTATE.

Northumberland and Durham.—In Northumberland and Tyne district the timber trade generally has been fairly brisk throughout the past year, although a few merchants have been complaining. Business in mining timber has been exceedingly active, but, as there is a plentiful supply of this class, prices are still keenly cut.

Newcastle is really the chief market for most of the timber in the district other than that for the various mines, so that Newcastle prices are to a large extent a reflection of the prices

obtainable in the districts north and south of the Tyne, both in Northumberland and Durham, and they also regulate or modify the prices in more remote districts in those counties.

Inferior timber, from overgrown coppices and over-thinned plantations (of which, unfortunately, there is a good deal), is of little value, and in districts remote from railways this class is very difficult to market. On the other hand, clean, well-grown timber, no matter what the species, always meets with a ready sale.

Another point which tells against the sale in home timber is the intermittent nature of the supply. In some districts timber may be offered one year to the extent of causing a glut in the market, while, for some years following, little, if anything, is to be had, with the obvious result that the timber merchant has to go elsewhere to a more reliable source, and oftentimes never returns. Why cannot landowners have a "working agreement" as well as the railway companies in order to regulate and steady the output, and so study their own interests?

Oak is in good demand, especially for colliery purposes, and there is a good call also from cartwrights for spokes, shafts, etc.

American ready-made shafts compete with this branch of the home trade, but really good English oak more than holds its own. For boat-building, also, oak is still in request.

Good ash, too, is greatly in demand amongst carriage and roller makers. Really prime ash is scarce, and small, inferior ash is bad to market, being only used as "chocks." Ash handles and shafts were formerly much manufactured, but American hickory, partly owing to the scarcity of good quality ash, has largely supplanted it, as good hickory is preferred to poor quality ash. However, where ash can be grown of really good quality, it still offers a good outlet in favour of the grower, and, if it can be put on the market steadily, there seems no reason why it should not yet in turn supplant the hickory.

Elm (the Wych variety only is grown in this district) is not much in demand, but, if of good quality, is always saleable.

There is a limited local market for large beech, but clean, well-grown butts, 16 inches and over, can always be well sold.

There is not much offered in this district, however. Smaller beech is always readily bought for cutting into "chocks," but of course at a smaller price.

Sycamore is in moderate demand, and large-sized, well-grown trees command a good price. It is not plentiful in this district.

Both Scots pine and spruce make a poor return, but the timber is often rough, ill-grown stuff, and really is not worth much. Landowners in this part of the country are slow to adopt the Continental methods of growing coniferous timber, with results very detrimental to themselves.

Larch is in good demand, and really full-sized, sound, large-hearted boles are scarce about here. Many owners use a considerable amount of larch themselves for estate purposes, and consequently have not much to offer. Small larch, which can be cut for sleepers, baulks, etc., meets with a ready sale, and a good many larch poles are used in the round, both for coal and lead mines. Boat-builders still use larch, and trade in this class of stuff is good.

Within fifty miles of Newcastle by rail, and in woods not too remote from a railway station, say five miles distance, the following prices would hold good—over-bark measurement:—

			s. d.	s. d.	
OAK—First-class, 16 in. and over	...	...	1 3 to	1 9	cubic foot.
Smaller, to 12 in.	...	...	0 10 "	1 0	" "
SYCAMORE.—Large size	...	...	1 6 "	2 0	" "
Small	...	...	0 5 "	0 11	" "
ASH	...	...	1 0 "	1 6	" "
LARCH	...	...	0 10 "	1 2	" "
Small	...	...	0 8 "	0 10	" "
BEECH.—Large and clean	...	...	0 9 "	1 0	" "
Ordinary	...	...	0 4 "	0 6	" "
SCOTS PINE and SPRUCE	...	...	0 3 "	0 4	" "
BIRCH and ALDER	...	...	0 3 "	0 5	" "

There are hopeful signs of landowners turning to more rational methods of dealing with their woods. It is perhaps too much to expect that private owners will extend their wooded areas, and this is scarcely to be wondered at under present conditions; but there seems to be no reason why they should not treat their existing woodlands in such a way as to give better returns in the shape of high-class timber. The insane method of thinning out coniferous woods (and indeed all

others) immediately they have entered the thicket stage, is largely responsible for the present poor crops, of poorer quality, with consequent low prices procurable for British-grown timber. Owners are beginning to realise this, and there is every reason to believe that the production of the near future will consist of full crops of well-grown, clean timber, that will always command a good price and ready sale in the market.

(Compiled from matter supplied by Mr. J. F. Annand, Armstrong College, and Mr. A. T. Gillanders, Alnwick.)

J. P. ROBERTSON.



WOOD AT WESTON-SUPER-MARE.

Official Notices.

THE Publication Committee of the *Quarterly Journal of Forestry* is as follows:—

Arboriculture.—H. J. ELWES, F.R.S., Colesborne, Cheltenham; A. HENRY, M.A., F.L.S., Reader in Forestry, University of Cambridge.

Entomology.—A. T. GILLANDERS, F.E.S., Park Cottage, Alnwick.

Home Forestry.—SIR HUGH BEEVOR, Bart., 17, Wimpole Street, Cavendish Square, W.; W. B. HAVELOCK, The Nurseries, Brocklesby, Lincolnshire; J. P. ROBERTSON, Edensor, Bakewell, Derbyshire.

Forest Education.—J. SMITH HILL, B.A., Principal, Agricultural College, Aspatria, Cumberland.

Irish Forestry.—A. C. FORBES, F.H.A.S., Dept. of Agriculture, Dublin; A. E. MOERAN, Palmerston House, Portumna, Co. Galway.

Mycology.—M. C. POTTER, M.A., Professor of Botany, Armstrong College, Newcastle.

Advertisements and Exchange Column for Plants and Seeds.—E. DAVIDSON, Assistant Secretary, R.E.A.S., Haydon Bridge, Northumberland. Advertising Agents, Laughton & Co., Limited, 3, Wellington St., Strand, London.

Foreign and Colonial Forestry and Chief Editor.—W. R. FISHER, M.A., 6, Linton Road, Oxford.

As the Journal is published on the 1st of January, April, July and October any papers intended for publication should be sent either to the Chief Editor, or to one of the Sub-Editors, before the 15th day of the month preceding publication of any Number.

Official Notices.

ROYAL ENGLISH ARBORICULTURAL SOCIETY. 1908 SUMMER MEETING.

As intimated in the April number of this journal, the Summer Meeting will be held in Denmark. As the invitation of the Danish Government is restricted to a party of 50, a supplementary tour is also being arranged to take place in Ireland.

According to present arrangements, the Annual General Meeting will be held at Birmingham on Saturday, August 8th, at 10 a.m., and in the evening members will leave for Denmark, *via* Harwich and Esbjerg, and for Ireland, *via* Holyhead and Dublin. Both tours will occupy the whole of the week ending August 15th, and the approximate cost will be £12 and £8 respectively. Full particulars will be published in a few days, but it would greatly facilitate arrangements if the Secretary could be informed as early as possible of the names of those who have decided to attend either of these meetings. In the event of more than 50 names being received for Denmark, the Council at the last meeting decided to select the party according to seniority of membership.

EDWARD DAVIDSON,
Secretary and Treasurer.

A member wishes to purchase the following numbers of the "Transactions," that are out of print:—

Vol. II., Parts I. and IV.
" IV., " I. and III.

ERRATA TO APRIL No.

Page 127, eleventh line from bottom of page.
For Cupresoo, read Cupressus.
For Sisooo, read Sissoo.

CONTENTS.

ORIGINAL ARTICLES:—

	PAGE
Notes from Colesborne	151
The Conversion of Underwood and Coppice-with-Standards into Highwood	154
Conversion of Coppice Underwood into High Forest, in the presence of Ground Game	166
The Black Walnut	167
Volume of some Coniferous Timber Crops per Acre, in the County of Durham	175

OBITUARY NOTICES:—

Mr. A. Dubois	179
Mr. B. Cowan	181
Mr. Gueuning	182

REVIEWS AND NOTICES OF BOOKS:—

Report of the Departmental Committee on Irish Forestry	183
Forest Entomology	197
Report on Injurious Insects, etc., in the Midland Counties, 1907	199
Wood	200
Encyclopædia of Agriculture	204

CURRENT TOPICS AND SHORT NOTES:—

Lockeley Hall Estate, Hants—Propagating Elm	210
Sophora Japonica, or Pagoda Tree	212
Fall in Girth of Pines and Larch	213
"The Indian Forester"	214
Sales of Timber	216







PINUS SILVESTRIS, ABOUT 100 YEARS OLD.

Average height 90 to 100 feet. Average girth about 4 feet. Growing on oolite gravel about 600 feet above sea-level.- Lyde Bank, Colesborne, 25th April, 1908.

Quarterly Journal of Forestry.

No. 3.]

JULY, 1908.

[VOL. II.

Original Articles.

NOTES FROM COLESBORNE.

SCOTS PINE ON LIMESTONE.

THE frontispiece represents the lower part of a plantation of Scots pine, which was seen by the Society at Lyde, near Colesborne, immediately after lunch, on August 14th, last year. The trees are about 100 years old, and average about 4 feet in girth at 5 feet from the ground, and 80 to 100 feet high. The interest of the picture lies in the fact that, so far as I know, they were grown as a pure crop on thin dry oolite limestone, which is considered usually a very unsuitable soil for this species.

A certain number have been cut from time to time and found to be of very superior quality, those which have been sold, realising on the ground, eight miles from a station, 8d. per foot.

No natural reproduction takes place, owing, no doubt, partly to rabbits and partly to the nature of the soil. The photograph was taken on April 25 last, after the heaviest fall of snow ever known here, so late in the year.

It may be said that, though on the Continent *P. silvestris* is usually absent from limestone formations, yet in one district of Roumania it is, according to M. B. Golesco, of Campulung, found only on limestone. Seeds which I have lately received from this gentleman have been sent to Mr.

Fisher, to Mr. Havelock, to Mr. Baker, of Bayfordbury, to Capt. Hon. R. Coke, and to Mr. Mitchell, at Woburn, for trial, and will also be tried at Colesborne, with the object of seeing how the variety thrives in different parts of England.*

SPRING-FROSTS IN 1908.

The effects of late spring-frosts have been so severe on several trees planted in my trial beds, which were only hastily visited by the society when at Colesborne last year, that I think it worth while to note them as a warning to others not to plant any but the very hardiest trees in such "frost holes" as I was unfortunate enough to select, on account of the deeper soil and better shelter which I found there. Already in the first volume of our Journal, p. 169, I have noted the disastrous effects of a frost on the night of May 21-22 1905, and though this year there has been nothing so bad as that, yet on the night of June 14-15, we had a frost, which my thermometer registered as 8° below freezing-point. The wind was east but not strong, the moon full, and when I looked out at 5.30, I saw the ground white in the low-lying valley below my house. I may add, that in the same place on the night of June 6-7, the thermometer registered 7° of frost, and owing to the warm weather previously, many trees were more advanced in leaf than usual. The effects were most severe in the beds where the soil is heavy, and which the rising sun first strikes; wherever there was shelter from overhanging trees no bad effect was noticed, and at 15 to 20 feet above the ground I could see no trace of it. In my three nurseries, which are situated higher, and better sheltered by tall trees, no harm was done. I may add that, in the previous January, the thermometer fell to nearly zero in this valley, though in my walled garden it was not

* Mathieu (*Flore forestière*) says that *Pinus sylvestris* will grow in mountains on limestone, it being absolutely indifferent to the mineral composition of the soil, provided it finds the moisture it requires in the subsoil. Fliche adds a note to this, that very compact and hard limestones and stiff clays are unsuitable for this tree, and that it does not appear anywhere in the French Jura.—ED

below about 6°. The following trees seem to have suffered most from the spring-frosts.

Oaks, all varieties, have their youngest shoots and leaves blackened where exposed.

Turkey and Evergreen Oaks are more tender than common oak. Some rather weakly plants of the variety *tardissima*, raised from French acorns, being in a higher and more sheltered position, have escaped, but though later in putting forth leaves, this variety evidently can not be relied on in England as frost proof.

Sycamore.—Leaves of seedlings, which appear quite immune to harder frosts in March and April when germinating, are, strange to say, now much burnt where among grass.

Beeches are unhurt, their young leaves having been out long enough to become hard.

Walnuts.—All species much injured, the common walnut more so than *J. nigra* or *J. cinerea*.

Ash.—All species have young shoots frozen. Of the American ashes, Oregon seems less affected than green or white ash. South European and Japanese ashes suffer more than the common ash.

Tulip Tree.—Young shoots blackened.

Robinias.—The common species almost killed. *R. neomexicana*, from Texas, seems much hardier.

Hickory.—All young shoots killed to the ground in June. Unripe old wood much injured by winter-frost.

Cedars.—Lebanon and Atlantic hardly touched. Deodars had all young wood killed in winter.

Cryptomeria.—Much browned in winter, and unripe wood killed back. Must have shelter when young.

Cupressus macrocarpa uninjured where soil is dry, but badly cut on heavy soil.

C. sempervirens.—A number of Roman cypresses, six years old, which had withstood all previous frosts, have now succumbed to the winter of 1907—8.

Thuja gigantea.—A number of trees, which had been lifted to plant out just before the severe storm of April 25th, when we had about 6 inches of snow, followed by hot sun, have been injured very severely and most of them will die. But

the plants, which were not lifted until after this storm, are little, if at all, touched by the later frosts.

Larch.—I can at present detect no injury to any of the various species of larch, which, though very late in leafing this spring, had hardened their young leaves sufficiently to withstand the June frosts.

The result of these observations seems to indicate that the degree of frost is less important to young shoots and leaves, than the period at which it comes. With the one exception of the sycamore, it seems to me that the early leafing trees can endure frost better in mid-June than in mid-May, and that the later leafing trees, such as walnut, hickory, ash, and robinia, which escape May frosts because they are not out, suffer most from one coming in the second week of June.

But these observations may have only a local value, and it would be very useful to our readers if other foresters would record and compare their observations with mine.

H. J. ELWES.

“THE CONVERSION OF UNDERWOOD AND COPPICE-WITH-STANDARDS INTO HIGHWOOD.”*

FORESTRY enthusiasts and students of the progressive school of forestry are urging land-owners and land-agents continually to convert underwood and coppice-with-standards into highwood, in order that more remunerative returns may be obtained. It is, however, impossible to expect that owners or agents will revert from existing systems, until they are convinced of the following facts :—

1. That the depreciation of underwood *is general* (with the exception of particular localities), and *not local*, throughout the United Kingdom.
2. That underwood is not likely to appreciate.
3. That far higher monetary returns will be obtained by converting these woods into highwood.

The object of this paper is to show the reasons for the formation of these woods, the causes and extent of their depreciation and the best methods to employ in their reorganisation.

* This essay gained the silver medal of the R. E. Arb. Society, in 1907.





A 1.—The best specimen of Sycamore grown from underwood, age, 50 years; diameter, 16 inches 5 feet from ground.

—North Brinkin Wood, Ryston, Norfolk. (Vide p 167.)

A 2. -Section of same Sycamore, showing no sign of decay. (Vide p. 167.)





UNDERWOODS.

Underwood is composed of plants, which have been cut down close to the ground, and are capable of producing shoots from the "stool." This class of woods is found chiefly in certain districts where there was a particular demand for small produce for special purposes such as hop-poles, hoops, hurdles, and bark. The following underwoods are found in Great Britain, those marked (N. T.) being native trees.

Pedunculate Oak, N. T.—A light-demanding tree thriving best on clays or stiff loams, it is grown usually on a 15—25 year rotation, but this depends largely on the soil, locality, and the purpose for which the crop is required; where bark is an important consideration, the shoots must be cut before their bark becomes fissured, otherwise the amount of tannin is reduced considerably. Bark from underwood, which formerly realised £8 a ton, has been sold recently for 47s. 6d., and when the cost of peeling, amounting to 25s. a ton, loading, haulage, and railway freight is added, there is practically no profit left. Chemically prepared substitutes are responsible for this depreciation.

In Wales, this wood is being used largely for pitwood and logwood, its average price being £5 an acre for thirty years' growth; poles, not less than 6 feet 6 inches long and 4 inches in diameter at the smaller end, are worth 18s. to 23s. a ton, delivered at the colliery. The logwood is cut in 2 feet 2 inches or 3 foot 3 inches lengths and not less than 3 inches in diameter at the smaller end realises 14s. 6d. to 16s. per ton, and there is also a small market for hedge-crooks, pea and bean-sticks. The woods are assessed at 10s. an acre, the rates varying from 3s. 6d. to 7s. in the pound, the average being 5s. The returns where no charge is made for up-keep being:—

	£ s. d.
Value of wood.	. . . . .
Less rates	. . . . .
Profit	. . 1 5 0

or 10d. per acre per annum for thirty years' growth. These

156 The Conversion of Underwood and Coppice.

woods are being converted into highwood, being planted thickly with larch and Scots pine.

The return from bark and faggots on the Tavistock estate of the Duke of Bedford, in 1905, were as follows, from an area of 5½ acres :—

	£ s. d.
12 tons 12 cwt. of bark at £4 per ton	50 8 0
Faggots sold	33 6 0
	<u>83 14 0</u>
	£ s. d.
Cost of preparing faggots	27 10 6
Peeling and stacking bark, 50s. per ton	31 10 0
Carriage to station, 6s. per ton	3 15 7
Rail and delivery at Laun- ceston	5 0 0
	<u>67 16 1</u>
Profit	<u>15 17 11</u>

or a profit of £2 17s. 9d. per acre for twenty-five years' growth, giving a return of about 2s. 4d. per acre annually.

The Sessile or Durmast Oak, N. T.—This tree is very similar to the pedunculate oak, but thrives on soils possessing more sandy and gravelly characteristics and at higher altitudes, being susceptible to spring-frost ; it has a more upright growth than pedunculate oak and produces a greater volume of wood and bark, and is not nearly so liable to be damaged by the leaf-roller moth and gall-insects. It occurs chiefly in Wales, the north and west of England, and in Scotland and Ireland. It is used for the same purposes as the pedunculate oak.

Ash, N. T.—A very light-demanding tree, requiring a deep, moist soil, and thrives best in low-lying situations, especially in sunny valleys. The rotation usually employed is

one of fifteen years ; the produce is utilised chiefly for hop-poles, shafts, implement-handles, hurdles, crates and hoops, and for dairy utensils, the best quality realising £10 to £12 per acre. In Wales, Ash grown on a twenty-five year rotation realises as much as £25 per acre, for the best growth. The produce is used for handles of agricultural implements. *At the present time ash produces far better returns than any other underwood.*

Sweet-chestnut.—This tree is capable of bearing a considerable amount of shade and thrives best on deep silicious loams and in a warm situation. It grows particularly well in the south and west of England, and also in Ireland, but it is useless to attempt to grow it in cold exposed positions, or on chalk, or calcareous soils. The average rotation employed is eight to fifteen years, its chief uses being for hop-poles, fencing and hurdles. The cost of making four and five bar hurdles is 4s. 6d. and 5s. 6d. a dozen, and these sell for about 15s. a dozen. Chestnut and ash are used more extensively for hop-poles than any other underwood, but the introduction of wire-work in hop-gardens has decreased the demand for poles considerably and lowered the prices. Creosoted chestnut poles are preferable to ash, as the latter are liable to rot away at ground-level ; Ash is stronger and more elastic than chestnut, but less durable. The average number of poles obtained from an acre of good underwood is about 4,000, and previously to the introduction of wire-work, 400 poles were required annually to replenish the old ones. It is therefore evident that, where these poles were grown on a ten year rotation, one acre of underwood would afford a sufficient supply of poles for replenishing those required by 10 acres of hops. Poles, which, in 1878, realised 25s. and 30s. per 100, are now worth 7s. 6d. ; 12 foot poles, then realising 15s. per 100, are now selling for 4s. to 5s. ; whilst chestnut poles have depreciated from 50s., to 20s. per 100. Although the depreciation of ash and chestnut underwood is due chiefly to the introduction of wire-work, the use of larch thinnings for hop-poles has accentuated this fall in value considerably. The prices shown in the following table are obtained for chestnut underwood at Cowdray, the seat of Lord Egmont.

Area.	1885			1893			1900			1906				
Acs.	r.	p.	£	s.	.	£	s.	d.	£	s.	d.			
3	1	33	22	10	0	10	0	0	6	15	0	6	0	0
4	2	30	19	10	0	10	0	0	5	15	0	6	0	0

Alder, N. T.—This is a light-demanding tree, and thrives best in warm, low-lying situations and on soils containing an excessive amount of moisture, where no other species of underwood would grow, unless the soil was drained. Formerly it was used largely and realised a good price for charcoal, in connection with the manufacture of gunpowder and for staves for barrels; its chief uses at present are for clog-soles (the sizes of which vary from 6 to 12 inches in length, 2 to 2½ inches in width, and 1 to 1½ inches in thickness), backs of brushes, and for mop and rake-handles, in the south of England. The average rotation is twenty to twenty-five years, but a lower one is employed where the poles are required only for handles. Good crops for clogs realise £10 to £20 per acre.

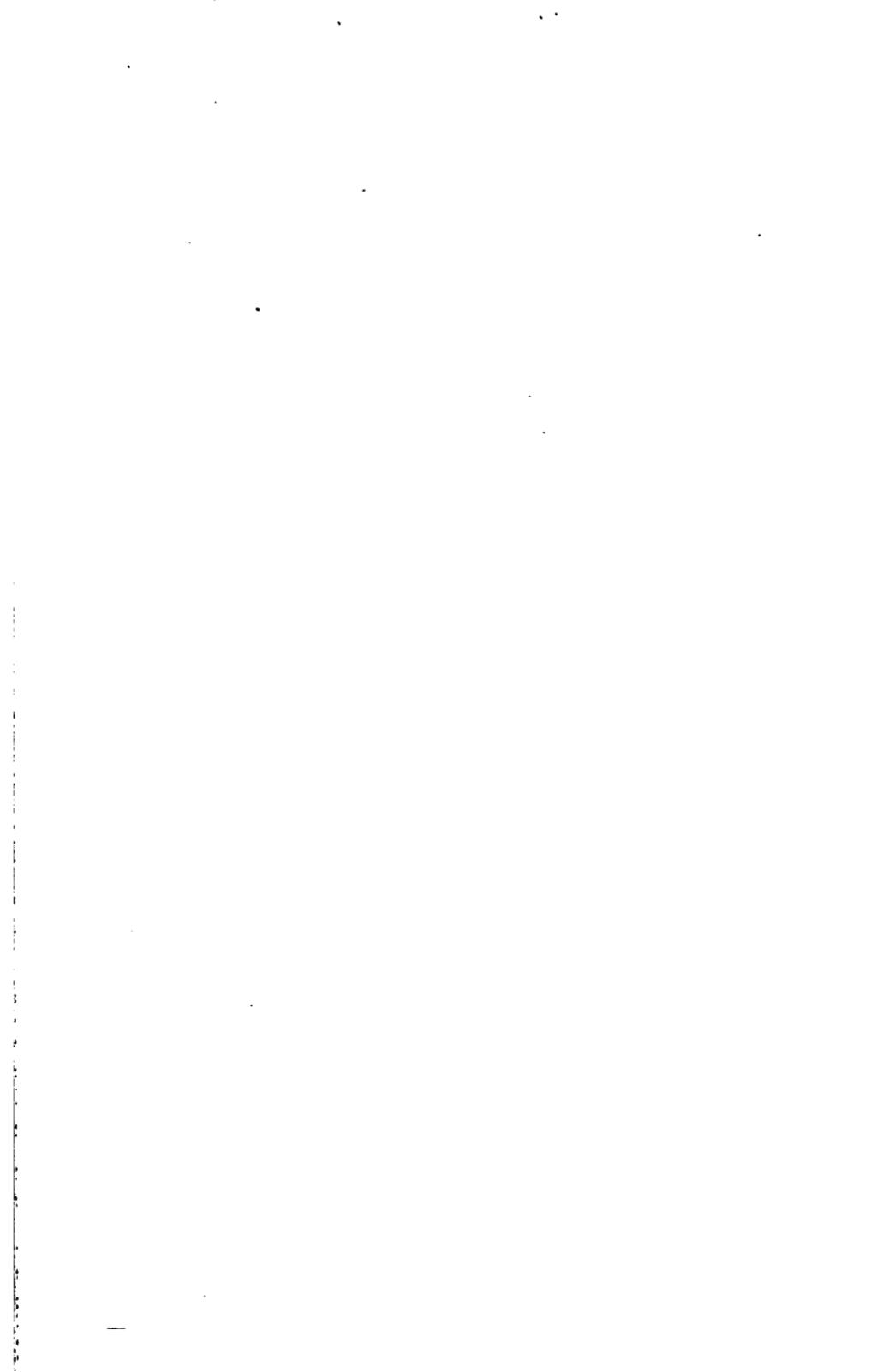
Hazel, N. T.—This plant is capable of bearing a considerable amount of shade, and thrives best on deep sandy loams. Formerly, it was used extensively and realised high prices in the pottery districts, where it commanded a ready sale for barrel-hoops and crates, when grown on a rotation of six to seven years. Its chief uses at present are for hazel fenders for the navy, and for hurdles.

Beech, N. T.—A shadebearing tree suitable for growing as underwood on calcareous soils, but as underwood possessing little monetary value, its chief uses being for firewood, bean sticks or pea boughs. It is liable to be damaged by late frosts, and its powers of reproduction from the stool are somewhat limited, but several crops may be obtained if it is worked on a rotation not lower than 20 years.

Sycamore, Norway maple, the small-leaved lime, hornbeam, aspen, sallow and birch occur as underwood, but are of secondary importance only. Of the above species, the stools of oak, ash and chestnut have the greatest vitality, alder and beech possessing considerably less, the three former trees are particularly liable to damage from ground-game, alder and beech being far more immune from this damage.



A 3. -Large Sycamores, etc., felled 1853, underwood cut 1886, leaving crop of standards as above, average girth 5 feet from ground, 42 inches. - North Bricklin Wood, Ryston. (*Vide* p. 167.)



The popularity of these coppice woods, in the past, is due to the fact that they were easily formed, and required very little attention beyond the occasional renewing of plants; they produced a good annual return in a short time and afforded good covert for game. They also cover the ground well, and provided the rotation is sufficiently long, they tend to clear the boles of valuable standard trees of their lower branches, but for this function of coppice, we must refer to the next section of this paper.

COPPICE-WITH-STANDARDS.

This system differs from coppice, owing to a certain number of standards being allowed to remain after the first crop of underwood has been secured to mature into timber. These woods were formed in districts where there was a demand for underwood for *general purposes*, and also for timber. The majority of these woods are now in a deplorable condition, and it is not difficult to ascertain the cause. The system of coppice-with-standards is a compromise between the two systems, of underwood (frequently termed "simple coppice"), and highwood; although first-class underwood and first-class timber can be grown on separate areas, it is practically impossible to grow the highest quality of underwood, or timber, on the same area. The main obstacle to doing this is caused by the fact that all trees require light, and the growth and full productive power of underwoods is decreased considerably by the shade of standards; it should be noted that the most valuable underwood are light-demanding species. It is acknowledged generally that the management of mixed high woods is far more difficult than that of pure ones, but the management of coppice-with-standards, especially if they consist of several species, requires greater skill. With the former woods, suitable species are grown to meet the requirements of soil, situation and local demand, but the varieties introduced for the benefit of the crop, or to produce income from thinnings, can be removed at any time when it is necessary to do so, but with coppice woods, both standards and underwood have to be maintained efficiently through rotations of various

lengths, and thinnings can take place usually only at intervals of eight to twenty-five years. When underwood was fetching a good price it was encouraged at the expense of the timber, the standards being over-thinned with this object, and in some cases also for the purpose of revenue; good underwood was obtained and the timber produced was readily saleable for the navy. In other cases the standards did not regenerate themselves freely, and an adequate supply was not maintained by planting to fill this deficiency. In a large number of cases the failure of natural regeneration is due to rabbits consuming the young seedlings.

RE-ORGANISATION OF WOODLANDS.

Owners, agents and foresters should, where it is possible, apply continental principles in managing woods in the United Kingdom, as far as possible, in order to obtain the highest possible financial returns (Continental woods yield nearly 30 per cent. more income than woods in Britain), and in order to do so the following points should be kept in view.

(1) To grow as large an area as possible under high wood.

(2) To raise low rotations of underwood to a higher age in order to obtain a better return for it, and to produce better standards (increasing the length of rotation enhances the upward growth of standards and restricts the production of lateral branches). On the estate of M. Boël, in Belgium, which was visited by the Royal English Arboricultural Society in 1905, it was found necessary to prune oak standards where the underwood rotation was fifteen years, but it was unnecessary where the rotation was 25 years.

(3) By stringently keeping down and killing every rabbit that can be found, as these animals are an absolute curse in woodlands, doing irreparable damage.

(4) By converting underwood where it is no longer profitable to grow it.

(5) Growing quick-growing varieties which mature early and are more profitable than slow-growing species.

Conversion of underwood may be carried out in three ways,

namely, by planting, natural regeneration, and conversion from stool-shoots, the method chosen depending mainly on the existing conditions of the woods, the one essential *sine qua non* in each case being the exclusion of rabbits, which abound in such quantities in this class of wood. The following will prove a useful and valuable fence:—stretching-posts, 100 feet apart, with intermediate poles of ash or chestnut 12 feet apart, wire netting 3 feet 6 inches wide, $1\frac{1}{4}$ inches mesh, threaded to a wire, stretched 6 inches below the top of each straining post and attached to the top of the intermediate posts. The netting is carried 4 inches below the surface of the ground and bent outwards to prevent rabbits burrowing, whilst another wire is attached to the top of the straining posts to prevent hares jumping the fence. A large number of woods under coppice-with-standards consist of areas with twenty to twenty-five umbrella-headed standards per acre, containing 10 to 20 ft. of inferior timber, worth about 1s. 6d. a foot, and underwood varying in value from 2s. 6d. to £2 an acre, according to local demand and the amount of care that has been taken to exclude rabbits. Many of the standards have thrown out epicormic branches, and these, instead of the crown of the tree, obtain the food from the soil, causing the standards to die from the top (stag-head), and be in an unsatisfactory state for the production of seed. This, in conjunction with the presence of the rabbits, and neglecting to plant saplings at each felling of the underwood, is responsible for the absence of seedlings and young trees. In dealing with such a wood the proper course to adopt is to cut and (if possible) sell the underwood and standards, and replant with a quick-growing, profitable timber tree, such as ash, larch, Douglas-fir, or sweet-chestnut, at about four apart, between the stools; 3,630 plants being planted, the cost of digging the pits, filling and treading in the plants, will be 2s. 6d. a hundred, and the plants 20s. a thousand for ash. The total outlay will therefore be:—

3,630 ash at £1 a thousand	...	...	£3 13 4
Pitting and planting at 2s. 6d. a hundred			£4 10 3
Per acre			£8 3 7,

exclusive of fencing ; but the amount realised for the underwood and timber will reduce the above amount to a certain extent.

The stool-shoots will require cutting back for the first two years after planting, the plants where possible should be one year in seedbeds and two years in the nursery lines, as they will then soon establish a complete overhead canopy, and kill out the underwood by their shade, especially if the tree planted is one casting a considerable amount of shade, such as sycamore or Douglas-fir. Where light-demanding species are utilised it is advisable to plant them closer if the plants can be purchased at a moderate price, for an overhead canopy is established more quickly by shadebearers. If the light-demanding trees consist of larch or ash, the extra outlay for planting will be repaid by the thinnings, which are always saleable. Shoots from the stool always show a greater height-growth than do young trees, and therefore every effort must be made to retard their growth. Where oak is grown for bark in coppices, the barking may be carried below ground-level to weaken the shoots, and the cutting of underwood at times when frost is likely to injure the stools will prove useful in other cases ; but this cannot be done with oak peeled for bark, as the wood has to be cut just when the sap is rising, otherwise it will not peel readily.

In exposed districts where the undergrowth consists of underwood, brambles and miscellaneous growth, the bulk of this should be removed, but patches should be left at suitable intervals to act as shelter for the young plants until they have become established. In woods containing a number of standards, which have not yet reached profitable maturity and are increasing in value annually, these trees should be left, the intervals being planted up with a quick-growing variety, care being taken to use shadebearers in those parts of the plantation where the shade of the standards might injure the light-demanding trees.

CONVERSION BY NATURAL REGENERATION.

This system can be adopted only where the plantation or wood possesses good healthy standards to act as parent trees.





B 1.—The worst example of Elm grown from underwood, age 36 years, 14 inches diameter 5 feet from ground.
Converted, 1886.—South Bricklin Wood, Ryston. (*Vide* p. 167.)



B 2.—Section of B 1, showing commencement of decay. (Vide p. 167.)



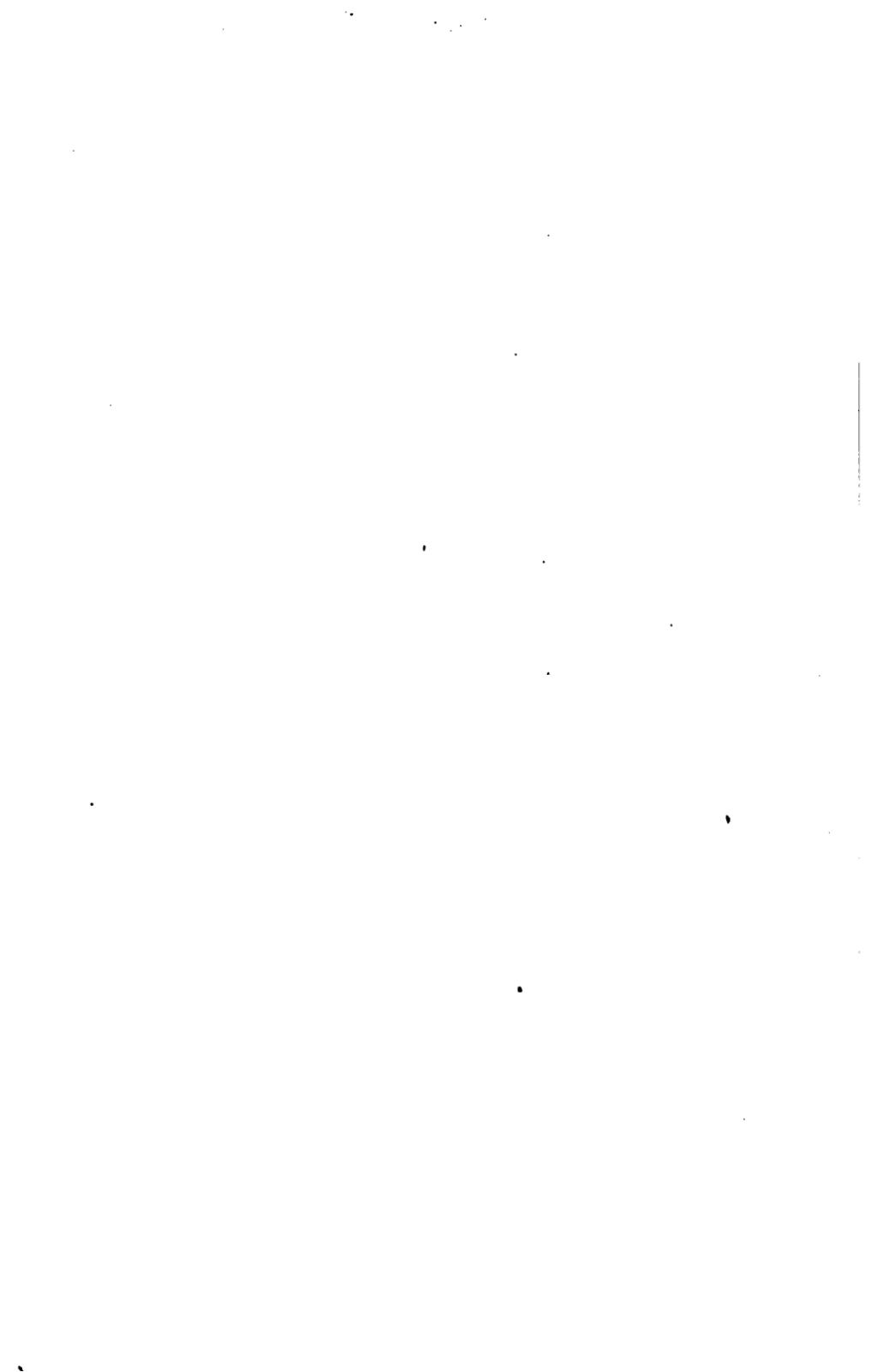
The only trees capable of being used for this purpose are oak, ash, beech and Scots pine, all these being native-trees. Where there is an extensive demand for birch, it may be used, and yields good returns where bobbins are manufactured extensively. Sweet-chestnut, though not a native tree, regenerates itself freely in the south-west of England and in Ireland. When a wood is to be regenerated, the underwood should be cut after a good seed-year, and also a certain number of standards, if their shade is likely to prove injurious to the young plants. Where the trees bear light or winged seed, such as ash, Scots pine, or birch, a plentiful supply of seedlings uniformly distributed will spring up the following year; but in the case of heavy seeds, such as acorns or nuts of beech and chestnut, the seeds do not get carried to various parts of the plantation, but germinate where they fall. If the surface soil is unfavourable to germination it should be broken with a fork in the vicinity of the standards. The disadvantage of this system is that the underwood requires cutting back more frequently than where planting is undertaken, as an overhead canopy is not formed so quickly. It is more difficult to obtain a full crop of seedlings than in regenerating high woods, where a felling is made of standards, termed a seed-felling, when a good seed year occurs. In the case of oak, seed-years occur every three to four years, whilst with beech, usually once in six to seven years. After this seed-felling the remaining standards are allowed to remain till another seed-year is reached, when the remaining trees are cut. Owing to the limited number of standards in coppice woods, usually it is possible only to have one felling. The seedlings come in patches and the blanks have to be filled by planting, but it has the advantage of being considerably cheaper.

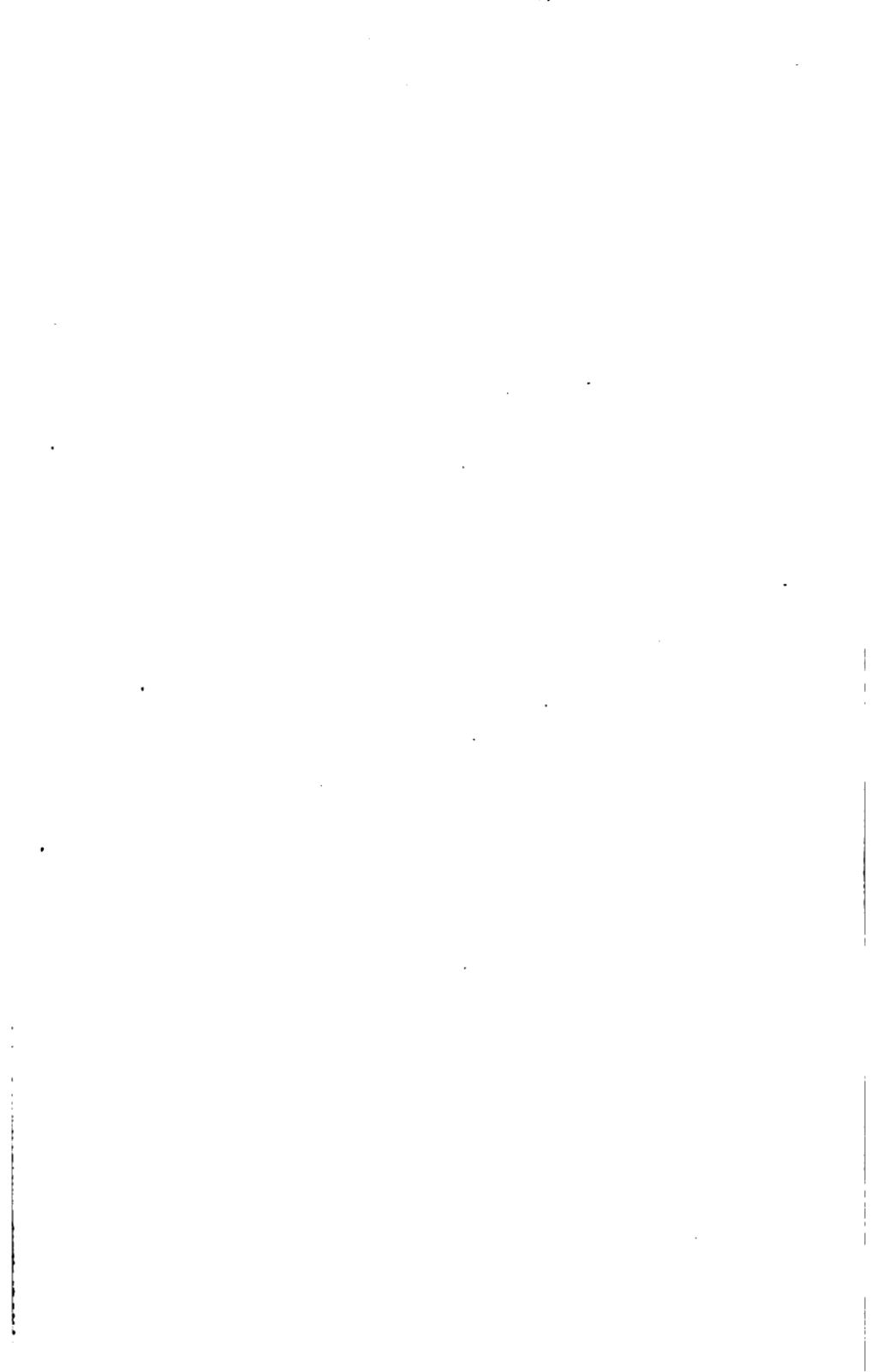
Conversion from stool-shoots may be carried out with chestnut or ash, provided the shoots are not too old, about six of the best shoots being left on each stool, and these are thinned gradually till only one remains; but care should be taken to select shoots which come close from the ground. Trees containing 20 to 30 feet of timber may be obtained thus, and though it will not be of very high quality, it may be sold for pit-timber and other purposes. Experiments with oak

have shown that this species cannot be converted profitably in this way, as it becomes black-hearted. Some of the Crown woods at Tintern are being converted into high wood, on these lines, owing to the depreciation in value of underwood.

In converting underwoods or coppice-with-standard woods, where the owner wishes to preserve game, a belt of low growth should be left on the outside margins of the wood to hide the guns, and the underwood left as cover should not be in large blocks but in small ones in sunny situations, as pheasants shun dark places. The amount by which the profits obtained from converted woods will exceed those formerly obtained, and depend chiefly on (a) the kind of tree which the soil and situation will support, and (b) the accessibility of a market for the disposal of the timber when the crop reaches maturity. Larch and ash are undoubtedly the two most profitable trees that can be grown, as the thinnings are saleable from the earliest periods and realise a good price, and the rotation only extends for a period of seventy to seventy-five years. In some cases, in colliery districts, higher financial returns may be obtained by growing the wood on a forty-year rotation for mining purposes. It is advisable to grow larch in conjunction with beech, as it is always far healthier when grown with this tree, and a larger amount of timber is obtained. Sycamore and chestnut are also very valuable trees and the former should certainly be grown more extensively, as there is a good demand for it and it realises a good price, especially in large stems, for rollers. This tree should be grown on an eighty-year rotation.

Chestnut is also an exceedingly valuable tree, but can be grown to perfection only on soils and in situations, which exactly meet its requirements, as it is not at all an adaptable species. It is used chiefly for building purposes, flooring, shafts and various other purposes. The rotation employed should not exceed sixty years, and if the conditions of locality are at all unsuitable, it should be cut when fifty or fifty-five years old, as it is very liable to ring-shake, after fifty years. The crack-willow and the Huntingdon willow grow very rapidly and soon attain timber size; the latter species is employed largely in the manufacture of cricket-bats. Care must be taken to plant these trees very thickly to obtain clean timber,





but afterwards to thin out freely in order to give large crowns ; they will not bear pruning, and each branch on the stem produces a knot. The rotations employed are twenty-five years and upwards.

Douglas Fir.—Next to the larch, this tree is the most valuable conifer grown in Great Britain. It thrives best on a deep, fresh, sandy loam and requires a sheltered situation, otherwise its leader is very liable to be broken by wind ; like chestnut, it will not grow on calcareous soils. To obtain the highest quality of timber this tree should be planted pure, 4 feet apart, otherwise clean stems cannot be secured, and usually the plantations do not require thinning until twenty years of age. As the plants are so expensive it is better to plant small ones pure rather than larger ones mixed with larch or spruce, as the Douglas-fir smothers the latter trees, and when they have overtopped them, the Douglas fir are not sufficiently close to prevent extensive branch-formation, and timber of inferior quality results. Care should be taken to secure the Pacific coast variety of Douglas-fir, as though the Colorado variety is supposed to be hardier, it does not grow more rapidly than spruce. The timber is used for building and other purposes of a similar description. The length of the rotation employed in the cultivation of this tree may be as low as forty years, or as high as eighty, but probably sixty years will be found the most profitable for general purposes. All the above trees will be found to yield better returns than more slowly growing varieties, such as oak or beech, and they are far more suitable than the latter trees for estate purposes, as they yield quicker and higher returns. There is urgent need for reconstruction in the majority of woods in the United Kingdom, and this can be achieved only by impressing on owners, that far higher returns can be obtained from them when this has been done, and that loss instead of profit is incurred on several of them at the present time, although the majority of owners and agents appear to be ignorant of these facts.

F. A. OSMOND SMITH.

CONVERSION OF COPPICE UNDERWOOD INTO
HIGH FOREST, IN THE PRESENCE OF
GROUND-GAME

IT is admitted that underwood has frequently no saleable value; many articles that were made of small wood are made now of iron, etc.; coal has replaced faggots for fuel, for baking, lime-burning, etc.

The model wood of fifty years ago consisted of underwood with some twenty oak trees to the acre, the larger the branches the better for the wooden ships for which they were intended. Now, neither the trees nor the underwood can be said to pay any interest on capital. Many owners therefore are replacing these woods with high forest of deciduous trees, in some instances of conifers, which is the proper course to adopt; but in a great many woods rabbits and hares still exist, and to such an extent, that planting leads only to disappointment and loss.

When young trees are planted in underwood it will be noticed that always they are bitten in preference to the shoots of the stools around them. This may be accounted for by the fact that a plant newly put in, with less than normal vitality, is sweeter, or rather less acid, than a coppice-shoot, and thus yields a more palatable food.

It is therefore desirable for some owners of woods containing underwood, other than hazel, to consider, whether there is not an inexpensive way of producing HIGH WOOD, while yet retaining the advantages of their rabbit-shooting.

On leaving Cambridge, in 1869, knowing something of the classics, but nothing of forestry, I had to devise the means of replenishing some of my woods without parting with the rabbit. The five plates show the nature of the results in some cases, which, on the whole, may be considered to have been successful.

Undoubtedly the most payable underwood for conversion into high-forest is ash, and one of the easiest to convert. In the last five years I have sold £1,500 worth of ashwood, 9 to 24 inches diameter, 5 feet from the ground, at prices ranging from 1s. 6d. to 3s. per cubic foot, according to the relative



C 2.—Large Ash, and Elms felled 1853 and 1884, underwood cut 1886, leaving crop of standards as above; average girth, 3 feet from ground, 36 inches: inferior poles thinned out, 1904. Five per cent. of these culled poles unsound 12 inches from ground.—South Bricklin Wood, Ryston.

distances from railway-stations. All, or nearly all these trees, were grown from the stool, and some 90 per cent. may be said to have been sound trees. The price would show that the quality was good, and in some instances, very good.

The sycamore, Fig. A 1, is shown by plate A 2 to have no sign of decay. The remnants of the original stool are, however, very apparent. In plate A 3 two groups of trees are shown. In 1886 these stools were very strong and about ten years old. The best single stem only was left. Ten years afterwards the new competing stems were cut, and but little trace of them remains, though more than enough to explain their history.

In the representation of the elm, Fig. B 1, one of the worst specimens has been chosen. The tree is straight and clean but not upright. In Fig. B 2, the commencement of decay is visible, the rotten core being about 4 inches in diameter. This rot is below the ground-level, and possibly the tree might have increased its diameter to some 24 inches before the rot appeared above ground. The other plates, B 3, C 1 and C 2, speak for themselves.

On the whole, it may be contended that, where there is ground-game, this method of replacing coppice by high wood is not undesirable. The final crop will be sound till the trees reach a diameter of 24 inches, and this is a saleable and convenient size for transport. Beyond other trees, ash lends itself most readily to this system, and is most saleable at this size.

EDWARD ROGER PRATT.

RYSTON HALL, NORFOLK.

THE BLACK WALNUT.

THE following information has been condensed at my request by Mr. D. C. Trier, Geddington, near Kettering, from a long paper, which appeared recently, and which so entirely confirms all that I have said in the "Trees of Great Britain and Ireland," vol. II., pp. 263—270, that I think it will be useful to English foresters.

Though the summers are too short and too cold to justify the planting of the black walnut in the north and west of England, yet in the southern, eastern and east central districts it grows at least as fast as the common walnut, and attains as large dimensions, whilst its tendency to form a clean trunk and its endurance of severe winter-frosts is superior. The following measurements of trees which I have seen myself show where it succeeds best:—

BLACK WALNUT IN ENGLAND.

Locality.	Soil.	Approximate age.	Height.	Girth at 5 ft.
1. Marble Hill, Twickenham	Alluvial	About 100 years	98 ft.	14 ft. 3 in.
2. The Mote, Maidstone	Deep loam	About 100 years	103 ft.	12 ft. 6 in.
3. Chilham Castle, Kent	"	...	105 ft.	13 ft. 6 in.
4. Bisham Abbey	Alluvial	4 trees in grove	90—100 ft.	8 ft. 2 in.
5. " "	"	...	...	10 ft. 3 in.
6. " "	"	...	...	8 ft. 6 in.
7. Albury, Surrey	Greensand	104		
8. Gatton Park, Surrey				
10. Corsham Court, Wilts.		...	75—80 ft.	11 ft. 5 in.
11. Lacock Abbey, Wilts.		About 120 years	100 ft.	11 ft. 6 in.
12. Mamhead Park, Devon	Red sandstone	...	90 ft.	10 ft. 7 in.
13. Spixworth Hall, Norfolk		...	80 ft.	12 ft.
14. Wimpole, Cambridge		...	75 ft.	12 ft. 8 in.
15. Brightwell Park, Oxon.		About 50 years	68 ft.	5 ft. 8 in.
16. Colesborne .	Poor dry oolite	About 70 years	60 ft.	3 ft.
17. Fulham Palace, London				

REMARKS.—1. Spreading habit. 2. Spreading. 3. Spreading. Contents about 400 ft. 4. Clean bole 50 ft. 6. Clean bole 20 ft. 7. Felled. At 17 ft. from butt, had 77 rings heartwood and 27 of sapwood, produced over 100 ft. good timber. 8. Felled. According to Mr. Cragg's measurement produced 315 cub. ft. timber. 10. Clean bole 35 ft. 12. Very spreading habit. 13. *Fide* Sir H. Beevor. 14. *Fide* Sir H. Beevor. 16. Tall clean bole. 17. 16 ft. girth in 1879. Died about 28 years ago when nearly 200 years old. *Fide* Loudon.

I may add that having used the timber of three English-grown trees for furniture, I am convinced that it is at least as good in quality as that of the common walnut, while the colour is much richer, and if I had any land good enough to grow it I should not hesitate to plant this tree largely with the utmost confidence. I should endeavour to procure the nuts from trees in Canada or northern New York, rather than from trees in the western and southern States, which are more easy to procure through seedsmen. English-grown nuts, as far as my experience goes, do not produce such strong plants.

H. J. ELWES.

Extracted from a paper by Forstmeister Rehmann, in the "Transactions of the German Dendrological Society, 1907," pp. 187—209.

The black walnut was introduced into Europe about the year 1629. Various writers have dealt with the tree, notably Duhamel (1755), du Roi (1772), Michaux (1810). It was not, however, until after the year 1882, when John Booth, in a work on exotic trees, published in Berlin, drew attention to its value as a timber tree, that serious notice was taken of the possibilities of the black walnut.

Since that time various authorities in America, on the Continent, and in the British Isles have from time to time discussed the value of the tree both from the ornamental as well as from the commercial point of view.

In the last few years many experiments have been carried out, especially in Germany, Austria and Belgium, with the object of ascertaining its true value as a commercial timber tree. The author of the paper from which this article has been extracted now records the results of his experiments and observations extending over a period of twenty-five years. These should be of considerable value to foresters and others interested in arboriculture.

DISTRIBUTION.

The native home of *Juglans nigra* is the United States of America. According to the report published by the Bureau of

Agriculture of that country in 1905, the black walnut is described as being distributed over a very large area of that country, being found in the colder as well as in the warmer regions, and is stated to be one of the most generally distributed species of that country. In the woods of Tennessee and Carolina it is found in mixed woods of oak, lime, chestnut sycamore and other hardwoods—never pure.

In Europe the tree is found, as the following table will show, almost equally widely distributed.

Locality.	Height above sea-level.	Age.	Diameter of bole at 4 ft.	Height.	Remarks.
Hechingen, South Germany	ft. 1,650	Years. 65	ft. in. 1 6	ft. 56	Deep clay soil.
Würzburg, Central Germany	520	100	3 0	90	Soil 18 in. deep, containing lime.
Posen, East Germany		30	0 11	36	Sandy soil. Ripened its fruit in 1906.
Munich, Bavaria	1,690	60	2 8	75	Several trees, all flourishing.
Interlaken, Switzerland	1,720	100 (about)			Healthy tree.
Gisselhof, Denmark	95	120	2 6	60	Remarkably fine tree.
Mahnoë, Sweden	95	30	2 3	36	Healthy young tree.
Strassburg, South Germany	420	70	2 11	114	Good loamy soil, gravel subsoil. Water level 6 ft. below sur- face.
Schwertzingen, South Germany	350	100	2 3	80 to 100	Gravel soil. Sand liable to floods.

It will be seen from the above list that the black walnut flourishes at considerable elevations, as the examples near Munich and Interlaken show.

In addition to this it appears capable of standing great cold, as shown by those in Sweden and Denmark. The author states that in the winter of 1879-1880, when many oak, elm and fruit trees suffered severely from the frost in Germany, the black walnut escaped without hurt. This is the case only

where trees have thoroughly ripened their previous year's wood.

Although *Juglans nigra* does not grow so rapidly or attain such large dimensions in a cold, as in a warm, climate, yet it would appear that it would still pay to grow at considerable elevations and in localities where it would be subject to much cold in the winter.

SOIL-REQUIREMENTS, ETC.

The tree has been described generally as one requiring a good, deep, well-drained soil, with a sufficient amount of moisture to reach its maximum development, and the observations of the author tend to corroborate this description.

A reference to the above table will, nevertheless, show that it will grow well on a great variety of soils, from a deep clay to a light sandy soil, or one containing lime. A certain depth of soil and subsoil is necessary, that will permit of a proper development of its root-system.

CULTIVATION.

A curious feature of the black walnut is the great length of the tap-root. This reaches, in the case of one-year-old trees, a length of 2 feet or more and it is of a thick, fleshy nature. Until the tree is two or three years old the tendency of this taproot is to force its way down into the soil, and it is only after this age has been reached that fibrous roots are formed in any quantity or the root commences to branch.

The usual method up till now has been to grow the trees in nurseries, and to plant them out when four or five years old in the places where they are intended to remain. The roots owing to their great length have had to be heavily pruned, and without doubt this has been the most usual cause of failure in growing this species.

Out of 1,000 four-year-old trees, carefully grown in a nursery and planted out by the author, only thirty survived this root-pruning.

To avoid this, the trees should be grown from seed sown where the trees are intended to remain permanently.

There are several points to be observed in doing this.

To obtain the best results the nuts should be germinated before sowing them in their final positions. It is important that this should take place before the end of May, so that the young shoot has the warmest months of the year in which to develop, otherwise the wood does not ripen and the tree is cut down by the frost in the following winter.

To ensure this, the nuts should be sown in November in a sheltered spot, in the nursery or in a garden, 3 or 4 inches below the ground, and covered in frosty weather with a good layer of straw or leaves. As the nuts germinate and the shoots appear above the ground, the plants should be lifted and planted out in the woods, or wherever they are to be grown.

Care must be taken to guard against the attacks of rats and mice.

This will be found to be the best and most economical method of avoiding failure, and consequent gaps in the planting.

The cost of the nuts in Germany is about 9d. per pound, about fifty going to the pound.

The land to be planted should be well-prepared the previous autumn, so as to be ready for the reception of the germinated nuts.

If, however, it is found more convenient to plant young trees they should be grown from seed in the nursery in soil not too deeply cultivated, so as to discourage a too vigorous growth of the taproot, and planted out when not more than one year old.

If only a few trees are required for ornamental planting, a simple plan is to sow a few nuts in a deep basket and sink it in the ground. The basket can be lifted when the trees are three or four years old and the roots separated, with very little damage to them.

CHARACTERISTICS OF GROWTH, ETC.

The black walnut may be considered to be one of the most light-demanding of all trees. If grown shaded by other trees it develops very slowly and becomes stunted and unhealthy.

The average results of a trial carried out to prove this showed, that trees five years old grown without sufficient light

reached only a height of from 2 to 3 feet and a diameter of less than half an inch, while trees grown under suitable conditions of light reached a height of from 7 to 9 feet and a diameter of from 2 to 3 inches.

Although the tree suffers no damage from winter-frosts, save where the previous year's wood has not ripened thoroughly, yet spring-frosts do considerable damage to young trees, as, if the weather should be mild early in the year, the sap is apt to rise before the normal time, and growth commences. The damage thus caused is not of a permanent character, and the tree has a considerable power of repairing the harm done. Care should be taken not to grow it in lowlying, and other situations, which are especially prone to late frosts. Specimen trees or those standing alone are more liable to be frosted than those planted in woods where shelter is given to them by the surrounding trees.

In the case of single trees, paper or straw wrapped round the leader is often sufficient to prevent any serious harm being caused.

In growing the tree for commercial purposes the most successful method the author has found has been to clear strips about 8 feet wide in a coppice, or coppice-with-standard wood, when the coppice-shoots are four to six years old, and to plant the trees 3 feet 6 inches apart, either pure or mixed with some shade-bearing tree, as the beech. By this method the trees are sheltered laterally by the coppice-shoots, and yet receive sufficient light from above. If the coppice-shoots should grow too rapidly and tend to choke the young trees, they can be cut back easily.

Another method is to plant groups of black walnut in places where large standards have been felled, at the time the coppice has been cut. Plantations should be thinned, and suppressed trees taken out, at approximately the tenth, fourteenth and seventeenth years. The exact periods for doing this must be left to the judgment of those in charge of such plantations.

ROTATION.

The author states that, the most profitable rotation under which to grow the tree is from 70 to 75 years on a good

black-walnut soil. A well-grown tree averages at 70 to 75 years 2 feet 10 inches in diameter and 105 feet in height.

It is interesting to note that a black walnut at seventy-five years equals in cubical contents an oak at 150 to 160 years of age.

TIMBER.

As no quantity of European-grown timber has yet been put on the market its value can be estimated only by that of imported American timber. In America large sums are paid for fine samples, one tree mentioned in the official reports selling in the winter of 1905 for the enormous sum of £1,150 (23,000 marks). The price is rising rapidly owing to the limited supply.

INSECT PESTS AND ENEMIES.

The black walnut suffers less from disease, insect and other pests than almost any other forest tree. According to the U.S.A. report of 1905, it is stated of the tree that "although occasionally attacked by leaf-eating and boring insects, yet in no case has any serious damage been reported." These attacks, too, are of local and not general occurrence. On the Continent no damage worth noting by insects has yet been recorded. The cockchafer occasionally damages the foliage. Field-mice have been known to gnaw through the roots of young trees just below the ground-level.

CONCLUSION.

Of the many foreign trees which have of recent years been recommended as valuable additions to those of native growth, few, if any, would appear to be more worthy of extensive planting in suitable localities than the black walnut.

As an ornamental tree its value is considerable. As a timber tree, its rapid growth, freedom from disease and attacks by insects, the beauty and value of its timber, should induce those who have the opportunity to give it a thorough trial.

In conclusion, Professor Jentsch, in an interesting report on

American timber-trees, speaking of the black walnut states that, "owing to the ruthless felling of the more valuable timber trees in America the supply of black walnut has almost come to an end, and the value of this timber is bound to rise very considerably in value in the near future."

VOLUME OF SOME CONIFEROUS TIMBER CROPS PER ACRE, IN THE COUNTY OF DURHAM.

AS an accurate indication of the results of the methods of silviculture in vogue in this country during the last twenty years, and for the purpose of comparison with the tables contained in Vol. III. of Professor Schlich's "Manual of Forestry," I offer the following details of a plantation in the north of England.

The plantation, a rectangular block of 11 acres in extent, is situated at Stillington, co. Durham, on an estate belonging to Merton College, Oxford, at an altitude of about 200 feet above sea-level, and eight miles due west in a direct line from the sea. The soil is an undrained loamy clay of the boulder clay formation, of an average depth of not more than 1½ feet, overlying the new red sandstone 50 to 100 feet below. The surrounding country is gently undulating and the site of the plantation slopes towards the south-west at an average angle of 10 degrees, the only shelter being a slight rise towards the north. The trees forming the crop, Scots pine and larch, with a few Norway spruce irregularly interspersed along the boundaries, were planted 4 feet 6 inches apart in February, 1888, on arable land, which in the previous year had been cropped with wheat. As some indication of the quality of the land, it may be remarked that the produce of the entire area was sold standing for the sum of £5, *i.e.*, 9s. per acre; the average price per imperial bushel of wheat being at that time 4s. 1½d.

Since the formation of the plantation no filling of blanks was made to replace the trees that perished, with the result that the trees now stand somewhat thinner on the ground than they would otherwise have done. In the autumn of 1905, the

176 Volume of some Coniferous Timber Crops.

southern half was cleared of all dead and dying trees, white-thorn and briar growth, at a cost of £5 10s.; the northern half has just now (February, 1908) undergone similar treatment at a cost of £5 5s. These are the only items of expenditure that have been incurred during the twenty years' progress of the plantation.

The figures given in the following tabular statements are collected from three sample-plots, each one-tenth acre in extent, measured in the interior of the plantation.

SCOTS PINE (45 per cent. of crop).				
Diameter in inches.	Number of trees.	Basal area, sq. ft.	Number of trees.	Basal area, sq. ft.
2	30			
3	72	3,535		
4	73	6,373		
5	33	4,501		
6	8	1,570		
			186	15,979
	216	15,979		

Mean sample-tree of plots.		Real sample-trees.			Volume of plots. Solid cubic feet.
Basal area. sq. ft.	Diameter. ft.	Diameter. ft.	Basal area. sq. ft.	Volume, cub. ft.	Timber over 3 in. diam. at small end.
		3'66 4'42	'073 '106	'743 '940	
'086	4'0	Total .	'179	1'683	150

(LARCH (55 per cent. of crop).				
Diameter in inches.	Number of trees.	Basal area, sq. ft.	Number of trees.	Basal area, sq. ft.
2	140			
3	71	3,486		
4	42	3,667		
5	9	1,228		
			122	8,381
	262	8,381		

Volume of some Coniferous Timber Crops. 177

LARCH—*continued.*

Mean sample tree of plots.		Real sample trees.			Volume of plots. Solid cubic feet.
Basal area. sq. ft.	Diameter. ft.	Diameter. ft.	Basal area. sq. ft.	Volume, cub. ft.	Timber over 3 in. diam. at small end.
'068	3'5	3'26	'058	'457	
		3'40	'063	'468	
		Total .	'121	'925	64

The figures per acre are as follows :—

	Number of trees.	Basal area, sq. ft.	Volume. Solid cub. ft.
Scots Pine	720	53	500
Larch	873	28	213
Total	1,593	81	713

Now let us compare this result with the Yield Tables for high forest of Scots pine, compiled by Schwappach for North Germany (Schlich, Vol. III., pp. 362—365), which supply the following data :—

Quality of locality.	Number of trees.	Basal area, sq. ft.	Volume. Solid cub. ft.
Best			
Average	1,420	98	1,000
Mean		71	400
		84.5	700

From this we note that the quality of the locality under consideration stands about midway between "best" and "average," assuming that the tables referred to are applicable to a mixture of Scots pine and larch.

178 Volume of some Coniferous Timber Crops.

Glancing back at the summary of the total yield per acre of the plantation, we should not hesitate to say that the soil and situation are far more suitable for the Scots pine than the arch.

Now let us enquire more closely into the relative suitability of the locality for the two species. To that end, suppose that each were grown as a pure crop.

In the case of the Scots pine (taken now to be 100 per cent.), the figures per acre would read as follows:—

Number of trees.	Basal area, sq. ft.	Volume.	Solid cub. ft.
1,600	118		1,110

Compared with the data given by Schwappach in his Yield Tables for "Best Quality," we observe that the above exceeds the normal density for a crop of the same age. Therefore reducing the number of trees to the normal, and the basal area and volume in proportion, the result is:—

Number of trees.	Basal area, sq. ft.	Volume.	Solid cub. ft.
1,420	104		985

This, we observe, agrees closely with the Yield Tables for "Best Quality."

To enable us to deal with the larch in a similar manner, we must include all material below 3 inches diameter, seeing that the preliminary Yield Tables for high forest of larch, used in Saxony (Schlich, Vol. III., p. 380), refer to all wood above ground, that is to say, exclusive of roots and stools. The volume in this case works out to be 390 cubic feet of timber plus 473 cubic feet of fuel, or a total of 863 cubic feet.

The data supplied by the Yield Tables are as follow:—

Quality of locality.	Volume.	Solid cub. ft.
Average	1,140	
Lowest	360	
Mean	750	

Our figures therefore approach more closely to the "Average" than to the "Lowest Quality of Locality."

By the aid of the foregoing data, we see not only the past development of this plantation, as compared with samples of German forestry, but also we are better able to estimate its progress in the future, and to obtain a sounder judgment as to the treatment to which it should be subjected.

CYRIL MOISER, P.A.S.I.

Obituary Notices.

MR. A. DUBOIS, DIRECTOR-GENERAL OF THE BELGIAN FORESTS.

THE Belgian Forest Service has lost its capable chief. Mr. Alexandre Dubois, Directeur-Général des Eaux et Forêts, died on April 13th, at the age of sixty-four, of appendicitis, a malady from which he has suffered probably for many years. Dubois was esteemed and beloved by his assistants. The Royal English Arboricultural Society has reason to remember their splendid reception in Belgium, in 1905, that he arranged, and he was unanimously elected an honorary vice-president of the society.

Dubois, during his twenty years of office, has reorganised completely the Belgian Forest Service. The number of inspectors (divisional officers) has been raised from six to eleven, that of the sub-inspectors and *gardes généraux* (range officers) from twenty-six to thirty-two; the brigadiers' (foresters) charges have been fixed; the protection of fisheries improved; and the salaries of the forest-guards increased. The central administration also was established by him, for before 1881, it was carried on by the financial department, by men absolutely ignorant of forestry.

Under Dubois' direction, most of the State and Communal forests were put under regular working-plans. Formerly these

forests were managed only according to established custom or routine. Now more than three-quarters of the Belgian public forests have been studied in detail by forest officers, mapped, and placed under rational treatment, in accordance with the present state of forest science. The planting of waste-land has been expedited, and State forest officers advise communal authorities in the management of their woodlands, while grants of public money have accelerated the planting of unproductive areas.

One of the most important works undertaken by Dubois is the purchase by the State of private forests, that were in the market, or were disappearing owing to bad management, or of heather land, which has been planted with trees. During the last eight years the area of the State forests of Belgium has been increased by about 20,000 acres, and during the last ten years, experimental works have been inaugurated to ascertain the best methods of restocking blanks, the best systems of management, the use of manures, the results of working the soil, thinnings, mixtures of various species of trees, and the introduction and use of exotics. Thus experimental areas have been established all over Belgium, and have spread a knowledge of forestry throughout the country. Dubois busied himself with making the landowners and the public generally acquainted with forestry, he assisted landowners in the management of their woods, and instituted numerous conferences on forestry, at which forest officers presided. He also fostered public instruction in forestry and the consultation of forest officers by private owners of woods.

Dubois soon discovered that an educated and capable forest staff was indispensable for the proper administration of woodlands; so that suitable instructions for candidates for forest posts, both superior and subordinate, were provided. The agricultural colleges at Gembloux and Louvain were founded with his advice, and a fourth year added to the original course of study, during which the students might learn to understand the Belgian forests. In fact, it is not sufficient to study silviculture in books and by attending lectures: students must learn also the application of principles in the woods of the various forest regions. The professional training of young forest

officers in Belgium is completed by four years of practical training in forests, partly abroad, and partly by passing an apprenticeship under specially selected Belgian range officers, who teach them their duties. This question, indeed, is of the highest importance, for the Belgian range-officer administers areas of 20,000 to 25,000 acres of woodland, worth several million francs; also he has to deal completely with the waste land in his district, with game and fisheries, to supervise, teach and direct fifteen to twenty-five foresters and guards; he has to deliver addresses at meetings for the discussion of forest questions, and to give advice to landowners on the management of their woods. Such work requires the service of well-trained men of considerable ability.

For the subordinate staff of foresters and guards, Dubois has provided forestry instruction at the military schools of Bouillon and Diest, since many of the forest subordinates are soldiers in the army reserve; also instruction for civilians at schools in the chief woodland districts of the country. He wished to improve and complete this branch of forestry instruction, but his painful malady and other obstacles prevented him from finishing this part of his work.

This notice gives an incomplete sketch only of the work that Dubois has accomplished, as the first director-general of the Belgian forests. Dubois possessed rare qualities of heart and mind; he was kind, courteous and generous. No one in want of money, or in a humble position, appealed in vain to him for assistance. He was beloved by the officers of his staff, whom he treated as members of his own family; he always tried to conciliate opponents. He was enamoured of his forests. What he has achieved is good and permanent; we trust that his successor may carry still further the reforms that he has commenced so wisely, and that he may give to Belgian silviculture its proper place among other branches of human activity.

N. F. CRAHAY.

MR. B. COWAN, ONE OF THE VICE-PRESIDENTS
OF THE R.E.A. SOCIETY.

WE regret greatly the death at South Shields, in his sixtieth

year, of Mr. Bernard Cowan, F.R.H.S., who has been superintendent of the local cemeteries for the last thirty years. He was head-gardener to Sir William Hatt, of Gibside, and afterwards of Sir Henry Clavering, of Anwell Park, and after his appointment to the South Shields cemeteries, he greatly beautified them by artistic arrangement of trees, rocks and shrubs, as well as by splendid beds of flowers. For some time he conducted a course of lectures in botany under the Durham County Council. He attended regularly the council meetings and tours of the Royal English Arboricultural Society, and was an auditor of the accounts of that society.

Mr. GUEUNING.

Mr. Albert Gueuning, the manager of the Duke d'Arenberg's estate at Raismes, near Valenciennes, when quite a young man succeeded his father in the charge of the important forest of oak and other standards there. Members of the Royal English Arboricultural Society visited this woodland in 1902, and the Royal Scottish Arboricultural Society did so in 1905. It has been seen repeatedly by Mr. Stafford Howard and other officials and woodmen of the Crown Forests, and by the probationers for the Indian Forest Service.

Everyone who has visited the forest of Raismes will hear with great regret, the announcement of the premature death, at the age of forty-seven, of Mr. Gueuning, who always has been so courteous to our countrymen, and so ready to show them the very interesting forest, which he has managed so long, to the great advantage of the d'Arenberg family.

Reviews, and Notices of Books.

REPORT OF THE DEPARTMENTAL COMMITTEE ON IRISH FORESTRY, 1908.

THIS committee was appointed on the 29th August, 1907, consisting of Thomas Patrick Gill, Esq. (chairman); the Right Hon. Lord Castletown, K.P., C.M.G., D.L.; William Redmond, Esq., M.P.; Most Rev. Dennis Kelly, D.D.; Hugh de Fellenburg Montgomery, Esq., D.L.; William Frederick Bailey, Esq., C.B.; William Rogers Fisher, Esq., M.A.; Professor John Ritch Campbell, B.Sc.; with Denis J. McGrath, Esq., as secretary.

The report is dated Dublin, 6th April, 1908, and it occupies 60 foolscap pages of print, with 484 pages of minutes of evidence, appendices, and index. It is in many respects a monumental piece of work, dealing with all aspects of the question.

The question of Irish forestry is one that has occupied people's minds for a good many years. There is abundant evidence that Ireland was once extensively wooded and that its climate and soil are suited naturally to the growth of timber. The areas under wood having been reduced in the course of time to about 1·5 per cent. of the total area, a movement was set on foot about a quarter of a century ago, more especially by Dr. Lyons, to increase the area, and thus provide an additional amount of work for the people of the country. Dr. Lyons, if we remember right, induced a Danish Forest Conservator, Dr. Hawitz, to visit Ireland and to give his opinion on the subject. The report drawn up by Dr. Hawitz was, however, not definite enough to make a lasting impression.

Towards the end of 1885, Dr. Schlich visited Ireland, and the late Earl of Carnarvon, then Viceroy of Ireland, hearing of his visit, asked him to give an expression of his views. This he did in a pamphlet dated January, 1886. (See pages 319 to 328 of the Appendix.) In this pamphlet Dr. Schlich set forth the general question, and urged extensive afforestation. More particularly he proposed to acquire surplus lands, not required

for agricultural purposes, under the existing Land Act, and to convert them into State forests. The pamphlet reached the Earl of Carnarvon in January, 1886, and before it had left the press a change of Government took place, and no action was taken on it. Now, twenty-three years later, the report before us practically turns upon that very suggestion, with such modifications as further experience and investigation have called for.

The report deals with the subject under ten heads. The committee put before themselves the question—

“What are the principal objects to be attained by any scheme of afforestation supported by public funds?”

and they answered it as follows:—

“The maintenance of an area of woodland sufficient to produce the supply of timber required by the country for domestic and farming purposes, for the development of industries and commerce essential to its prosperity, and for providing shelter needed for successful agriculture.”

The general conclusions arrived at are:—

“(1) That with the transfer of land under the Purchase Acts to peasant owners, an obligation in respect to existing woods, as well as other obligations connected with landed property, passes from the selling proprietors to the State;

“(2) That a comprehensive scheme of forestry, whether undertaken through local authorities, private owners, or directly through a Forestry Department, can be carried out only by or under the direction of the State;

“(3) That an exceptional opportunity, which can never recur, for acquiring land suitable for forestry, and not so suitable for any other use, presents itself now to Ireland, in connection with the Land Purchase Acts; and

“(4) That such a scheme, including the preservation and extension of existing woods and the creation of a new forest area, is a sound investment for the nation, necessary for her agricultural and industrial development and for the provision of an important capital asset which must otherwise be wasted.”

PART I. of the report deals with the present situation of Irish woods. The area of existing woods amounted, in 1907, to 306,661 acres, equal to 1·5 per cent. of the total area of the country, which is less than that of any other European country, except Iceland. It was found that this area is steadily shrinking, due to a variety of causes, such as the breaking up of large estates under the operations of the Land Purchase Acts. To counteract this effect a commencement was made by the Department of Agriculture to acquire wooded portions of such estates, but little could be done for want of the necessary funds. In consequence, woods were sold to timber merchants, who simply cut them down. The operation was hastened by the increasing demand for timber in England and Scotland and the accompanying rise in prices. Over two hundred travelling sawmills were set up within the past four years, which proceed from wood to wood, remaining only until the timber is cut down, and then moving to the next wood. The destruction is followed by but little replanting; the land is left derelict. During the last five years, 906 acres a year have been replanted, whereas at least three times that area should have been planted to make good what has been cut down. Moreover, from the woods now remaining the best trees have been felled, leaving an insufficient, miserable crop, and experts consider that this must be removed entirely and the areas replanted. To make matters worse, tenant purchasers have cut down shelter-belts of the greatest benefit to their own and adjoining farms, thus depreciating the value of their farms. It will take a generation to repair the mischief.

PART II. deals with the effect of the denudation on industry.

The most serious aspect of the present state of things is the menace to existing wood-working Irish industries, which are dependent upon the supply of homegrown timber. Some of these are of old standing, others have developed in recent years. The evidence given on this point shows that, if the present rate of destruction of Irish woodlands goes on unchecked, these industries will have to close their doors, thus causing a loss of employment to considerable numbers of skilled hands. The industries coming under this heading are

chair-making, cartwrighting, coach-building, furniture-making, packing-box-making, bobbins, spools, tool-handles, preparation of timber for the building trade and for railway-companies, etc.

Another great source of mischief is that, of late, owing to the sudden increase in cutting, as much as 72 per cent. of the total volume have been exported in the round, thus causing a loss of employment in the country, apart from the fact that the material for the continuation and extension of existing industries is lost.

These considerations alone justify, in the opinion of the committee, the conclusion that measures should be taken to save the existing area of woodlands from further misuse and for planting on an increased scale.

In PART III. of the report the committee advance their arguments for a scheme of afforestation. They point out the defects in the Land Purchase Acts and the urgent need for remedying them. They insist on the State, or some other public authority, taking on the duties formerly exercised by the disappearing landlords, more particularly as regards the woods.

An important point is that the acquisition of waste lands available for afforestation under the Land Purchase Acts has not been provided for sufficiently. This refers to all land not part of tenants' holdings. The importance of such acquisition was urged by Dr. Schlich twenty-two years ago, and it is a pity that his advice was not taken when the Land Purchase Acts were framed. To neglect the opportunity which the Purchase Acts now give the State of retaining for public use large areas of these lands, and to allow them to lapse into conditions of waste, would be an act of national improvidence repugnant to common sense.

The committee then proceed to demonstrate the desirability of afforestation. They point out the general advantages of forestry, Ireland's prospects and needs, lessons taught by continental forestry returns, the suitability of Irish conditions for timber growing, and Ireland's needs in respect of timber supply. It is pointed out that, guided by experience in other countries, there should be a supply of not less than ten cubic feet per head of population annually, requiring a woodland area of from 1,000,000 to 1,200,000 acres to meet it, apart from keeping up

the export of timber, or a possible further demand for fuel, that will develop eventually as the local bogs become exhausted. The committee feel safe in concluding that an area under woods of 1,000,000 acres, consisting of such land suitable for planting as cannot be more profitably employed in agriculture, should be regarded as affording not more than a moderate insurance for the agricultural and industrial needs of the country in the matter of timber, and that Ireland will not be managing her business as a prudent nation if she does not take every measure open to her at the present time to establish at least such a forest area.

PART IV. deals with the limits of afforestation in Ireland. The first question was to ascertain how much land is available and suitable for afforestation. Various enquiries were made, and certain parts of the country examined in detail. On the strength of the information thus collected, the committee came to the conclusion that, apart from existing woodlands (300,000 acres), at least 700,000 acres of land suitable for planting are available, coming under the following categories.

- (a) Large blocks of 500 acres or upwards.
- (b) Moderately sized blocks, from 100 to 500 acres.
- (c) Small areas of under 100 acres.

Of the total area, 200,000 acres were placed under (a), and 500,000 acres under (b) and (c).

The committee consider it safe to conclude that at least 5 per cent. of the entire country, including the 1.5 per cent. of existing woodlands, or a total of at least 1,000,000 acres, might be devoted to forestry without involving any disturbance of existing agricultural industries.

The committee take this round number, because they were not in a position to make a more exact estimate and because they believe that it is on the safe side. As to the latter, there can be no doubt. The statistical returns show :

Mountain and heath land	.	.	2,244,000 acres.
Bog, marsh, barren mountain land, waste, etc.	.	.	2,999,000 ,
Total	.		<u>5,243,000</u>

Allowing for land absolutely unfit for planting, land made over definitely to tenants, etc., we believe that the estimate of 700,000 acres given above is very moderate, and that ultimately a considerably larger area will be found suitable for afforestation. The experts who have suggested that area were, in our opinion, too cautious ; they judged too much by present appearances, and when the proposed scheme has been developed sufficiently, it will, no doubt, be found that considerable areas are fit for afforestation, which have for the present been rejected. Take, for instance, the extensive areas of bog and marsh. We believe, based on experience gained elsewhere, that all such land, which has mineral soil within three feet of the surface, can be made available for afforestation by a reasonable outlay. However this may be, the task which the committee proposes to undertake is great enough, and "sufficient unto the day, etc."

The problem to be worked out is thus given by the committee :—

(1) The proper utilisation through private owners and county councils of about 300,000 acres of existing woodlands.

(2) The creation of State forest on 200,000 acres of mountain or other rough land in large blocks to be acquired specially for the purpose, and managed directly by the State.

(3) The planting of a further 500,000 acres, chiefly in comparatively small blocks, through private owners and county councils.

PART V. deals with a National Scheme of Afforestation.

To be successful, action must be taken by the State, the resources of private owners being insufficient to undertake the scheme, owing to reasons which are self-evident, amongst which continuity of management is pre-eminent ; the State never dies, and it alone can guarantee continuity. It relies not alone on adequate financial returns, but also on the valuable indirect returns, economic and social, of the community as a whole. Next, attention is drawn to the responsibility of the State in Ireland in view of past neglect and present legislation, more particularly the mischief which has been done, owing to faulty legislation in the past. With provident and intelligent Government action in the past, the forest area and

the general agricultural wealth of the country would be in a far better position than they are now. Moreover, since the union, the quit and crown rents, which have yielded a return of upwards of £60,000 a year, have never been spent directly in Ireland or applied to Irish purposes, but have been invested in Great Britain. Having regard to these things, the committee have no hesitation in saying that, if action be not taken at once, it will mean a gross neglect comparable with the improvidence of the past and far less excusable.

The committee next point out that a forest authority already exists in Ireland in the Department of Agriculture and Technical Instruction. The department has taken some steps, such as the establishment of the Avondale Forestry Station, and of a system of forest education. Lack of funds has prevented its doing much more. It is proposed to provide the necessary funds and to develop the forestry section of the agricultural department, that section to be assisted by an advisory committee on forestry, consisting of persons with a special knowledge of woodlands and the timber industry, and representatives of county councils.

The duties of this forestry section should be:—

- (1) To acquire, under the Land Purchase Acts or otherwise, areas of land suitable for plantation, and existing woods.
- (2) To plant and manage such lands and woods.
- (3) To act as agents and managers in Ireland for the Commissioners of Woods and Forests, as regards lands to be acquired in Ireland for forestry purposes with the proceeds of the Irish quit and crown rents.
- (4) To arrange for the vesting in county councils of woods to be managed by local authorities and their management.
- (5) To arrange a scheme for encouraging private owners to develop and extend plantation on their lands.
- (6) To promote industries having special connection with woodlands; to facilitate the better organisation of the Irish timber industry.
- (7) To take charge of the system of technical instruction applied to forestry.
- (8) Generally, to bring within a comprehensive system of

administration a national scheme of afforestation for Ireland, and to administer that scheme.

These matters are discussed fully in the report, the details to be learnt from the report itself. The forest authority is to be given sufficient power to acquire land and existing woods, for which funds are to be provided, and to purchase grazing rights, where necessary. The larger blocks would remain in the hands of the department, while smaller blocks are made over to county councils. The latter are considered as singularly well suited for dealing with the problem of the smaller woods. They should be placed by the central authority in the position of tenant purchasers under the Purchase Acts, advancing purchase money in respect of woods or lands. The central authority or the Board of Works would make them an advance for capital expenditure on forestry or otherwise, repayable in instalments according to the returns from the woods. They should also be assisted with expert advice and supervision on the part of the central authority. The acquisition of lands and woods by the county councils should be undertaken only with the sanction of the central authority in accordance with a previously sanctioned scheme, or the central authority acquires and hands them over to county councils. In the management of these areas it is proposed to utilise the county surveyor and his staff, always under the general supervision of the central authority. The details are to be considered carefully by the county councils themselves and by the forestry section. Out of twenty-nine county councils, who have discussed the subject, twenty-five have adopted the proposed scheme.

The committee then deal with the question of private owners and forestry. Although a considerable proportion of the existing woods (300,000 acres) is likely to pass from their present proprietors to public bodies, the probability is that the greater portion will remain in their hands, thus creating a position which resembles that existing in other European countries. As things are now, it would be vain to count on any large extension of woodlands on private holdings in Ireland; hence encouragements to planting by private owners should be given.

The case of the small holder would, the committee think, best be met by an extension of the system under which trees are supplied at reduced prices, together with direct advice and assistance in planting. A system of loans through the Board of Works for planting purposes has been available for occupiers of this class under the Land Law Act (1881); but the fact that in the course of twenty-four years only six loans, involving a total sum of £805, have been granted, seems to indicate the unsuitability of the system, and to confirm the view that the system of the county schemes is the best in this case.

For the farmer holding 200 acres and upwards, and the larger landed proprietor, the inducement must be such that he would be relieved from the immediate lock-up of capital incurred in planting, while providing a guarantee that the outlay is a sound investment. Easy loans, with deferred interest, absolute security of tenure in respect of the lands, and free advice in all branches of forestry, are the chief means to meet the case. In the committee's opinion only interest on loan should be charged during the first twenty-five years, while the capital should be repaid by a scale of payments during the second period of twenty-five years. This is the scheme which has been urged repeatedly upon the attention of Government.

Mr. Munro Ferguson, in his evidence, expressed a positive opinion against a system of loans to private owners. We are glad to see that the committee adopted the former view and consider that these loans should be given under a system of safeguards. The committee are confident that resident proprietors, small holders, and tenant purchasers are willing to avail themselves of these facilities. On the other hand, the committee do not consider a system of bounties desirable.

PART VI. deals with the organisation of the timber industry.

The committee lament the utter absence of organisation in the utilisation of the produce of the forest, the waste going on, and the impossibility of home-grown timber competing with imported material; in fact, that Irish-grown timber is being treated almost as if it were a valueless product. All this is due to the absence of a regular, steady supply, which does not make

it profitable to construct proper machinery for conversion. This serious defect will cure itself as soon as timber is produced in sufficiently large quantities, when the forests are worked in accordance with systematic working-plans, and when the general rise in the price of imported timber, which commenced about fifteen years ago, has made itself felt. This is practically a financial question, and all pious wishes to remove the present shortcomings will not have much effect. The forestry section must, however, organise a system of instruction throughout the country, bringing improved methods to the knowledge of those occupied with the handling of timber in forest industries.

PART VII. deals with technical instruction relating to forestry.

The committee is impressed thoroughly with the importance of technical education applied over the whole field of the subject, whether for working woodmen, forestry experts, owners of woodlands, or those engaged in the timber industries and trade. It will take a considerable time to diffuse through the country the needful knowledge and skill and to establish fully the educational machinery by which such diffusion can be promoted. The committee consider that primary schools should lay the foundation. Young men of the rural labouring and farming classes should take up forestry as a regular business. The forestry authority should organise forestry education, the foundations of which have already been laid by the Department of Agriculture and Technical Instruction.

By the institution of the Department's Forestry School at Avondale, a considerable advance in this work has been made. The surrounding district is one of the best wooded in Ireland. The estate has been laid out as a forestry station according to approved principles, with forest plots intended to demonstrate the growth and development into timber of all the more important species of trees, also a pinetum and arboretum for botanical purposes. The intention in the first instance is the training of working woodmen, to be followed later on by more advanced courses. The apprenticeship occupies three years, the first year being devoted to general and science subjects, the second and third to forestry. In 1906-07, eighteen apprentices were in attendance.

With the adoption of a national forestry policy will come the need for higher forestry education, that is to say, for the training of expert forest officers and instructors. In this direction a commencement has been made by giving scholarships to students of Forestry at the Royal College of Science.

Public lectures on forestry have been arranged to educate the public mind generally in regard to the importance of forestry; leaflets, circulars, and other literature dealing with the subject are being distributed.

PART VIII. contains miscellaneous considerations. Legislative amendments are proposed to give effect to the committee's suggestions more particularly:—

(1) To prevent the cutting down of plantations on estates while negotiations are pending for sale, or where advances have been made under the Purchase Acts.

(2) To give powers to exclude from a holding, that is to be sold, any plantations or any land suitable for planting, with a view to its sale to a forestry authority.

(3) Power to acquire grazing rights on lands purchased for forestry purposes.

As regards the question of forestry and the problem of unemployment, the committee state their opinion emphatically that forestry cannot be considered as a specific for curing the evil. We doubt whether anybody in his senses has ever maintained that it is such a cure. All that has been advanced is that it is an *auxiliary* in dealing with the question. More especially, afforestation will cut off to some extent the current of migration from the country to the towns, by providing more labour of a healthy nature in the country.

Coniferous fast-growing species are recommended for the first crop, leaving it to future generations to retain or change them for other species. Possible, or impossible, natural regeneration of woods is touched upon, and ash, beech and Scots pine are mentioned as suitable for such a method. This will show that not much can be learned from the views of the committee on professional forestry questions.

Finally, the committee state that the question of the rating of woodlands does not appear to be a serious factor affecting forestry operations in Ireland, as woodlands are treated for

rating purposes as ordinary agricultural lands, assessable on the valuations made without reference to the timber.

PART IX. FINANCE.—The reader will understand that the financial aspect is really the crux of the whole business. The committee have therefore dealt with the question in great detail, while feeling all the time that the available data must for the present be conjectural. The price of the land, the time required for accomplishing the programme, the cost of planting, management and other working expenses, the probable returns, all these are matters subject to much doubt and uncertainty. Nevertheless the committee think that a calculation on a safe and useful basis can be made, and they have attempted it. They give alternative estimates for the 200,000 acres of State forest; for 50,000 acres of Crown woods managed by county councils; for a 200,000 acres area of large woods managed directly by the State; an estimate dealing with encouragements to private owners; and a summary estimate of the annual provisions required for the general scheme.

Those of our order who are interested in the financial question must be referred to the report itself. To us the method of calculation appears complicated, and in several instances unintelligible. To take one instance, the first, dealing with estimate (a) State forests, financial scheme for the acquisition, planting and maintenance of a new forest area of 200,000 acres directly by the State. Funds to be supplied by Parliamentary vote, money for the purposes being advanced under the Land Act of 1903, and repaid by annual instalments. It is assumed:—

- (1) That 200,000 acres of plantable land are acquired within 10 years, at the rate of 20,000 acres a year.
- (2) That the average price per plantable acre amounts to £4.
- (3) That the purchase money is repayable by annuities of $3\frac{1}{2}$ per cent.
- (4) That the cost of administration for the first five years is £3,500 annually and reaches £10,000 per annum in the tenth year, at which figure it becomes stationary.
- (5) That the cost of planting and working expenses on the

total area averages £500 per annum for each centre dealt with, and reaches a fixed maximum expenditure of £60,000 a year in the 40th year of the working of the scheme.

(6) That three-fourths of the acreage acquired is available for grazing until planted, and that the grazing rent averages about 1s. 9d. an acre on the total area, or 3s. an acre on the proportion of the area fit for planting.

(7) That the returns from thinnings and fellings average :—

£15,000	a year	in the third decade
£45,000	„	in the fourth „
£90,000	„	in the fifth „
£150,000	„	in the sixth „

and a fixed sum of £225,000 a year in the seventh and succeeding decades.

It is calculated that the mean annual expenditure would be :—

In the first decade	£17,925
„ second „	£40,125
„ third „	£48,000
„ fourth „	£40,500
„ fifth „	£6,000

That after this the receipts would exceed the expenditure by an annual sum of :—

In the sixth decade	£54,000
„ seventh „	£129,520
„ eighth „	£146,680
„ ninth and }	£155,000
remaining decades by }	

On the basis of these data the committee (or their actuary) have calculated the cost of the 200,000 acres at the end of the year '80, allowing 2½ per cent. compound interest. They give that cost as £3,267,600. Comparing this with the expected annual net-revenue after the year '80 = £155,000, they state that the invested capital will yield 4½ per cent. interest, besides leaving a surplus of £8,000 a year as a margin for variation or further development. To speak accurately, the investment would yield 4·7 per cent. compound interest.

We cannot help thinking that a mistake has been made in

this calculation. Taking the committee's own figures for returns and expenses, we find :—

(a) Amount (outlay with compound interest at the rate of $2\frac{1}{4}$ per cent.) of all net-expenditure during the first five decades, at the end of the year '80 } = £7,295,067

(b) Amount of all net-income during the 6th, 7th, and 8th decades, at the end of the year '80 } = £4,639,680

Net-outlay (a minus b) at the end of the year '80 = £2,655,387

Comparing this with the annual net-income of £155,000 expected after the year '80, we find that the latter represents 5·8 per cent. per annum on the capital outlay, or considerably more than the 4·7 per cent. calculated by the committee. However, there remains the great question whether the returns from thinnings and fellings estimated to occur before the year '80 are justified. In our humble opinion they have been placed at too high a figure. We cannot bring ourselves to believe that the thinnings and cuttings in the fourth to the eighth decades will be as high as those estimated by the committee, while the estimated grazing fees are a doubtful item, leading to a considerably higher capital outlay by the year '80. On the other hand, the sum of £155,000, estimated as the annual net-receipts after the year '80, may be accepted with full confidence, representing, perhaps, a percentage of 3 to $3\frac{1}{2}$ per cent. And this is, after all, sufficient, considering that the State can borrow at $2\frac{1}{4}$ per cent.

This part of the report closes with the proposal that the quit and crown rents should be invested in framing a national scheme of forestry. Whether this is done, or whether the State directly finances the scheme, makes after all no difference, except, perhaps, in a sentimental sense.

PART X. gives a summary of principal conclusions and recommendations. As we have dealt with all of these, we need only add that the proposals centre in the following points :—

(1) To provide for the maintenance and better management of the existing woods covering about 300,000 acres.

(2) To provide for the afforestation of an additional 700,000

acres to be taken from surplus lands not required for agriculture.

(3) To utilise the exceptional opportunities, which cannot recur, for acquiring land suitable for forestry in connection with the Land Purchase Acts.

We cannot omit expressing our regrets that the proposed acquisition was not commenced, when it was first proposed in 1886. Thus much time and much land have been lost.

(4) Provision for a staff of woodmen and forest experts, without whom the scheme cannot become a success.

There cannot be a doubt that the committee have done a sound piece of work. Let us hope that their rational proposals may be accepted and acted on by Government without further delay. The Irish question is practically identical with the land question, and any advance made in the satisfactory settlement of the latter must lead naturally towards the settlement, or we might say, the extinction of the former.

"FOREST ENTOMOLOGY." *

THE woods and forests of the British Islands, formerly so extensive as compared with what they are at present, and once holding so large a place in our national industries, are now, after a long period of comparative neglect, receiving their due share of intelligent and scientific treatment on the lines so successfully followed for a long time past on the Continent. The influence of insects on the well-being of our old woodlands, and even more so on that of the new plantations now being established in all parts of Great Britain and Ireland, is so great,

* By A. T. Gillanders, F.E.S., Woods Manager to His Grace the Duke of Northumberland. With 351 illustrations. William Blackwood & Sons, Edinburgh and London, 1908.

that it must always claim the serious attention of everyone concerned in their care and management; and the ability to recognise in all their stages of existence the various forms of insect life which attack and destroy arboreal vegetation, and the knowledge of the methods of dealing with their ravages, is an indispensable part of the equipment of the modern forester. Hitherto, although there is no lack of excellent treatises on the subject by Continental and American authors, we have had no book devoted entirely to economic forest entomology by an English writer, and in this respect the pioneer work of Mr. Gillanders is especially welcome. In accordance with the method of some of the leading German authorities, the subject is treated primarily from the entomological standpoint; and after a brief introductory sketch of the principal orders of insects, and a very interesting account of the often destructive *Eriophyidae* or "gall-mites" (that are not insects), the author proceeds to deal with those insects, which are primarily attached to arboreal vegetation, commencing with the most important order, the *Coleoptera* or beetles. In this, as in the other leading groups of insects, it is safe to say that no species with which the forester may be concerned at any time is omitted; indeed a good many forms are included here, which, however plentiful and destructive they may be in other countries, are only of rare or casual occurrence in Britain, though, as in the case of the remarkable bark-beetle *Xyleborus dispar*, they may in isolated instances give rise to a certain amount of damage. In each species the life-history is clearly and fully detailed, and in nearly every case the insect itself, and the characteristic injury, which it causes to the tree or shrub on which it feeds, are illustrated by one or more figures from various sources and of varying degrees of excellence, but on the whole very good and adequate for the purpose of recognition. The remedies for, and the methods of prevention of the ravages of the more destructive insects, are given in detail under each species where practicable. Perhaps the two most valuable and interesting chapters are those on the "gall-insects" of the oak (pp. 130—163) and on the *Coccidae* or "scale-insects" (pp. 201—239). In the section devoted to the *Lepidoptera* (the term being here used under the restricted title of "moths") we find on pp. 278—280

a very interesting account of a new pest of the larch, the Tineid moth *Argyresthia laevigatella*, Herr. Sch., a species now very injurious to the larch woods in Switzerland, but which has not yet found its way into the list of British moths, though it has within the last year been recognised as decidedly destructive in the larva state to the trees in Northumberland, and has, we believe, been observed also in the neighbourhood of Oxford. Very useful hints on the collection, preparation, and mounting of insects are given in Chapter XI., and insecticides and general remedies are discussed in Chapter XII.; while the list of trees with the insects affecting them, in Chapter XIV., brings into a very concise tabular form the chief forest insect-pests, and the nature of the injuries caused by each. Of necessity a large portion of the work is of the nature of a compilation from many sources, which in all cases are duly acknowledged, and we may congratulate the author of the work on the clear and methodical style throughout in which he has presented his subject. To those wishing to know something of the relations between our forest trees and their associated insects, as well as to everyone concerned practically with arboriculture and forest management, we heartily recommend this book, the excellence of the "get-up" of which is guaranteed by the name of the publishers.

J. J. WALKER, R.N.

REPORT ON INJURIOUS INSECTS, ETC., IN
THE MIDLAND COUNTIES, 1907.*

IN issuing the fifth report on the above subject Mr. Collinge states that, it is the last he will issue, as he has been compelled to resign his position in the University of Birmingham by lack of adequate financial support, and has accepted the directorship of the Cooper Research Laboratory, Berkhamsted.

An account of experiments made with insecticides and fungicides is well-illustrated by plates of an elm attacked by

* "Report on Injurious Insects and other Animals in the Midland Counties during 1907," by W. E. Collinge. Birmingham, Cornish Bros., 2s. 6d.

Polyporus squamosus, also of apples and apple trees sprayed and unsprayed. The lime and salt fluid, the composition of which is given, has proved useless, but V_1 and V_2 fluids, the composition of which is not given, are said to be most satisfactory, and "to be transforming the orchards of this country." A full report on this subject is promised at an early date.

Interesting experiments on spraying fruit trees and agricultural plants attacked by various insects are given, but those made on felted beech coccus and felted ash coccus are of chief interest to our readers, and in both cases V_1 fluid is recommended. The life-history of *Schizoneura lanigera*, the woolly aphid that attacks apple trees, is given. The ash psylla (*Psylla fraxini*) is said to be prevalent in Staffordshire and Worcestershire, and the life-histories of several beetles attacking osiers and willows are described, and remedies suggested; the chief of these are *Cryptorhynchus lapathi*, *Phyllodecta vitellinae* and *P. vulgarissima*.

The yellow wood-wasp (*Sirex gigas*) has been plentiful and tunnels the wood of conifers. The rest of this valuable report is of interest chiefly to agriculturists and gardeners.

WOOD.

By G. S. BOULGER.*

It is certainly an astonishing fact that England, which spends millions annually on purchasing foreign timber, has as yet produced no one capable of writing an accurate up-to-date scientific and practical handbook which will give the users of the woods known in commerce the information they require. I have no hesitation in saying that for want of such a work many thousands of pounds are wasted annually by government, by municipal authorities, and by private individuals. When I commenced to study trees, I soon found that there was no branch of the subject on which it was so hard to get correct

* Second edition, revised and enlarged. Edward Arnold, London, 1908.

information. With few exceptions, timber-merchants, architects, manufacturers, and artisans, though they may know the properties of the woods, which they individually handle or use, neither know nor care to know where they come from, what they are, or what other woods exist in the world they may best take their place, when, as in several instances, they become scarce and dear. Recently several works have been published on wood, amongst which Gamble's "Manual of Indian Timbers" is the only one of any real authority. Hough's "American Woods" is remarkable on account of the actual specimens shown in the form of thin veneers; but it is costly, cumbrous to use, and the origin of the specimens shown is not given. Holtzapffel's little book, though long out of date and written specially for the use of turners, is valuable as far as it goes; and Laslett, whose original work is by far the most practical and complete as regards timbers used in ship-building, is indispensable. But neither Marshall Ward, who published a new edition of Laslett, without adding much of real value to it, nor Stevenson, Stone, or Boulger had sufficient practical acquaintance with this very large and difficult subject, or have given anything like the time and trouble, to their works, that is necessary to acquire the requisite knowledge.

The result is that, architects, surveyors, builders and users of timber in various trades and manufactures, have to rely on their own experience and knowledge, which is usually very deficient; the timber trade of the country has no guide of authority, and many woods are sold under false and misleading names because no one knows what they are, where they come from, or what is their correct name. New woods are being introduced constantly and are often sold far below their actual value, because nothing certain is known about their properties, and, as a rule, the better class of consumers, taught by experience, are very shy of using any new material.

The author disarms a critic by stating in the first line of his preface that "perfect accuracy cannot be hoped for, completeness is impossible, and originality is neither expected or desirable." He cites no authority for many statements, which he ought to have known are incorrect or out of date. He acknowledges the assistance of Mr. J. A. Weale, of Liverpool,

but I feel sure that this gentleman, who has devoted much time and care to the microscopic examination and identification of timbers, and whose practical knowledge of many exotic woods is extensive, is not responsible for many errors and omissions, which one cannot help noting in going through the pages of this book. With regard to the first seven chapters of this work I have little to say ; they deal with a variety of subjects, and, as long as they are confined to generalities, are no doubt useful for teaching purposes ; but when we come to the second part, which is devoted to an account of the woods of commerce, we find that a great number of woods are mentioned, a majority of which have not, and never will have, any real importance to English wood-users, whilst the information about really important timbers is often inadequate, incorrect, or out of date. For instance, we find, p. 24, “‘*Ah-pill*’ (*Erythrophlæum Laboucherii*, *F. v. M. Order Leguminosæ*) Northern Queensland and North Australia. Probably the leguminous ironbark of Leichhardt, and also named *Laboucheria chlorostachys*, *F. v. M.* A medium-sized tree ; wood red, close-grained, very durable, and the hardest in Australia. Used by natives for spearheads.” Here are statements that may or may not be accurate, but they relate to a wood, which is unknown to anyone but botanists, who will certainly not be satisfied with the above unless they know on whose authority it is quoted ; and possibly to a few settlers in remote parts of North Australia, but not likely to be of use in England, even if it were available.

On p. 125, we find “Alder American or Hoary (*Alnus incana*, *Willd. Order Betulaceæ*) Germ. ‘Weisserle.’ A similar but inferior wood with more lustre, fewer pith-flecks, very few wide but indistinct medullary rays, has a wide range in North America.” Here is a tree of no special value, perhaps, for timber, but which has distinct interest for English foresters, who might like to know how it compares with common alder. (Mouillefert says it is very similar but less brittle and better for hoop-making). Its correct name, however, is grey, or white alder, and though common in parts of Europe and Asia, it is quite unknown in America, as the author might have ascertained had he referred to Sargent, whose manual he cites.

Page 129. Ash. A timber about which many more or less

obsolete and historical details are given, but little of real practical value. A number of other species incorrectly known as "ash" in various countries are mentioned, but not a word is said about Japanese ash, which has been imported recently in considerable quantities to Europe; *Acanthopanax ricinifolium*, a valuable Japanese tree, of which the timber is also imported and sold as Japanese ash or "Sen," is not mentioned at all.

Where Mr. Weale has added to this work, the information so far as it goes is generally correct, but if there are as many mistakes about the woods of which I am ignorant, as there are about those of which I have some knowledge, the work as a whole leaves very much to be desired. Let us take a few instances, p. 63. The bird's-eye variety of American maple is spoken of as a burr, which is quite incorrect, and the various causes and mode of growth of true burrs are unexplained. P. 85, "beech and yew are the staple woods of our Buckinghamshire chair-factories." I should be glad to know of any factory, which now uses yew at all; if American birch had been named instead, it would have been nearer the truth. P. 99, after speaking of the timber supply of Asia, that is dismissed in ten lines, Japan is mentioned very briefly without the least reference to its most abundant and valuable timber tree, namely *ryptomeria*, which on p. 280 is said to be "used for common lacquer-ware," and that is all. On p. 36 it is said that, *Robinia pseudacacia* includes at least four varieties of wood, red, green, black, and white. I am unable to trace the source of this statement, which is quite unsupported by anything I have been able to learn of this timber either in England, the United States, or France; and when described in detail on p. 205 nothing more is said about these supposed varieties, if they really exist.

No mention is made of several other timbers which are now imported largely, such as "Orham Wood," and "Primavera" or "White mahogany," though White mahogany is given as a name for a rare species of *Eucalyptus*, quite unknown to any one in England, so far as I can learn. The very valuable wood of the deciduous cypress, now and for some time past imported to England and likely to become an important commercial timber, is dismissed in a few lines with the following

very misleading and quite inaccurate remark, "so nearly identical with Redwood (*Sequoia*) as to be often so called." No one who had ever seen the two could possibly have passed that statement, and yet how easy to have procured the woods for comparison. But when we come to such a statement as the following, we wonder how it could have been written for English readers by an honorary member of our society. P. 200, "larch is not largely imported, that from Italy being small, crooked and cross-grained, that from Poland rather larger and straighter, and that from northern Russia the largest. When growing in the plains the larch has proved so susceptible to the attacks of the fungus *Peziza Willkommii* that it seems likely to be replaced as an object of cultivation by the Douglas spruce."

Briefly, it may be said that, whatever is copied or compiled from recent authors who know the trees they have described, such as Sargent, or whatever is written by Weale on personal knowledge, is valuable, and a great deal of the latter is new; but, as for the rest, I have quoted enough to show that this work cannot fill the place for which probably it was intended. With regard to the illustrations they are copied mostly, with acknowledgments, from works by other authors, but there are a number of enlarged microscopic sections of various woods by Mr. Weale, that will be of great value in showing the structure, and for identifying the woods they belong to.

H. J. ELWES.

"ENCYCLOPÆDIA OF AGRICULTURE."

"FORESTRY," BY THE RIGHT HON. SIR H. MAXWELL, BART.

WE complete the notes commenced in our April number on Maxwell's contribution to the "Encyclopædia of Agriculture," as now the last part of his "Forestry" has been printed.

The subject is continued under the heading, MAPLES. The fact that sycamore is called plane in Scotland, while the Norway

maple is termed *érable plane*, in France, supplies us with another reason for the importance of a knowledge of the botanical names of trees; popular nomenclature is very misleading, especially in colonies, where the names given to trees lead often to serious errors in silviculture. The sycamore attains magnificent dimensions in Scotland, there having been formerly at Kippinross, near Dunblane, a tree $42\frac{3}{4}$ feet in girth and containing 821 cubic feet; the brass plate recording these dimensions still exists, but only a rotten stump remains of this magnificent tree. Fifty pounds recently were offered and refused for a sycamore growing at Makerstoun, on the Tweed. Both sycamore and Norway maple are indigenous in the beech forest of the Ardennes, and there produce straight, long boles, that are not attainable when the tree is grown isolated, as is usually the case in Britain.

Maxwell says that the sycamore is not shadebearing. That term is, however, merely relative. Sycamore is more shade-bearing than oak, ash, pines, and larch, though less so than silver-fir, beech, and spruce. Saplings of sycamore force their way up through the shade of oak, ash, and larch, as may be seen in many English woods, and especially in Lord Bathurst's, at Cirencester. This tree reproduces itself from seed better than any other species, in woods containing rabbits, but wherever rabbits are excluded, oak, ash and beech reproduce themselves naturally from seed quite as well.

Under the heading of OAK, Maxwell concurs with Henry in considering sessile and pedunculate oaks as distinct species. Botanists have attended too much to the length of the petiole of the leaf of oaks, which is no certain guide in this case; the TWO SMALL EMARGINATE AURICLES AND GLABROUS LEAVES of the pedunculate oak are never found on sessile oak; the leaves of the latter are always pubescent in the angles between their lateral veins and mid-rib. Maxwell does not hold the opinion that is universal on the Continent regarding the relative water-requirements of the two species, though these differences lead the sessile oak to grow in drier situations than does the pedunculate oak. The fact is obscured in Britain, because sessile oak prevails in the moister climate of the west, while pedunculate oak prevails in the drier climate

of the east of our islands. But it is a question of soil and not of climate, both oaks growing in the comparatively dry climate of Greece. Scrub oak of either species is not very particular as to soil, but the important question for foresters is where fine oak timber can be raised.

Classic examples of the soils producing the two oaks may be seen at Compiègne and Bellême. There, on sandy plateaux (at Bellême with a slight capping of loam), the sessile oaks attain to magnificent dimensions, while the pedunculate oak thrives on the loamy soils below, near Bellême, in every hedge-row. In Britain, on millstone-grit, in the Peak district, there is a wood, a century old, where every pedunculate oak is dying and every sessile oak in full vigour of growth. In Woburn, on the sandy plateau, sessile oak is thriving among the pine trees, while pedunculate oak is very poor; and the same fact may be seen in Lord Macclesfield's woods on the Chiltern Hills above Shirburn Castle. In Wales, Ireland, and the west of Scotland, where sessile oaks thrive, though the rainfall is heavy, the soil is either calcareous and permeable, or on slopes steep, rocky, and well-drained, or on impermeable clay; there is not usually enough permanent subsoil water for the thirsty pedunculate oak. The wet, deep-soiled, loamy river-valleys of England and the Continent—those of the Thames, Trent, Severn, Rhine, Meuse, Danube, Seine, etc.—are the real habitats of the pedunculate oak, even where the rainfall is slight, as it is in the Rhine Valley. The leaves facilitate transpiration in the pedunculate oak and resist it in the sessile oak, as any one may see who examines them. The acorns of the two species are arranged for the opposite reasons, for the pedunculate oak, lavish with its water, pushes its acorns out into the solar heat on long peduncles, so that they may ripen, while the sessile oak, which economises its water-supply, keeps its acorns sheltered by the foliage and connected directly with a twig, that can supply it with more water than would a long peduncle, and thus the acorns are not liable to be shrivelled by the sun.

When Maxwell says that the New Forest is essentially a pedunculate oak country, does he speak of its sandy or its clayey areas? and have the prevailing oaks there sprung from

indigenous seed or from planted parents? There is no pedunculate and no sessile oak country, properly so-called, but there are soils that will produce splendid sessile oaks and others that produce equally fine pedunculate oaks. He also says, that the name DURMAST refers to the dark colour of the acorns of the sessile oak. May it not refer to these acorns being DUR, or hard for the digestion of swine?

The arrangement of species adopted is alphabetical, so that osiers are separated by a wide interval from tree-willows; but it is convenient to refer to them both here. The common osier, *Salix viminalis*, is termed *S. alba viminalis*, as if it were a variety of the tree-willow, *S. alba*; but this is contrary to the opinion of botanists.

Maxwell contrasts the statements of E. R. Pratt, in the October number of our Journal, with that of Nisbet in "The Forester" (i. 147). The latter says that crack-willow fetches a higher price for cricket-bats than does white willow, while Pratt maintains that white willow is preferable for all work. Bean, in "Kew Bulletin," No. 8, states that "no bat-maker will look at an open-bark willow," and that all crack-willows have coarse, open bark. Bean, however, in opposition to Pratt, says that the best bat-willow is *Salix alba cærulea*, a bluish-leaved variety of the white willow, and not *S. alba viridis*, a hybrid between the white and crack-willows. "A bat made of good *S. viridis* would weigh 2 lbs. 7 ozs., one made of *S. cærulea*, 2 lb. 4 ozs.; and for good trees of the same size a dealer would pay £10 for the blue willow, but only £6 for the green willow."

Maxwell notes that the Corsican and Calabrian pines are proving themselves of more prospective value than any other pines introduced into Britain. Seedlings of Corsican pines alone withstand rabbits, while the Calabrian pine mixes well with oaks. He counsels planters of Scots pine to get their seed from Scandinavia or from British pines of well-known good quality, as much seed comes from worthless pines of central Europe. Whether the quality of timber is inherited from the seed, or not, is, however, questioned by some silviculturists, and we hope to deal with that matter in our October number.

White poplar is said to be probably indigenous in the south and east of England. The aspen, called "quaking ash" in Scotland, Maxwell says, is properly *asp*, from the A. S. *asp*; "aspen" is merely an adjective, like "wooden." In the Chiltern Hills, this tree is called *aps*. The grey poplar, probably a hybrid between these two species, equals the white poplar in its dimensions and commercial value, and the aspen in its indifference to soil and hardiness. This good reputation of the grey poplar is shared by French wood-merchants, who term it the *bâtarde*, or the *grisard*, and prefer its wood to that of the Canadian or the white poplar.

Pyrus Sorbus, the service tree, is as characteristic of calcareous soils as the mountain-ash is of silicious ones, though Maxwell does not refer to this peculiarity. It is a prominent tree and very highly prized for its fine-grained wood, as a standard over coppice on French calcareous soils. It might be grown as a standard over coppice on oolitic hills in England and on the mountain limestone in Ireland.

Sequoia sempervirens is probably the fastest-growing valuable tree in Britain, but we are always warned about the difficulty of rearing it from seed on account of its susceptibility to frost. The writer of these notes reared about fifty plants in a nursery on the Bagshot sands without any protection against frost, and even were protection required it is not very difficult to supply it. *Taxodium distichum* is quite hardy, and is a good tree to grow on wet land. The tulip-tree is also hardy, but brittle against wind. Its timber is imported extensively into England.

Except willows, already dealt with, and *Zelcowa*, which is last on the list, the only other species requiring mention are the walnuts, of which there is a fairly long account. Sir W. Thiselton Dyer submitted twenty species of wood as substitutes for common walnut to the British army small-arms factories. None of them were found satisfactory except black walnut, the planting of which was recommended by Evelyn 250 years ago. Maxwell speaks of the difficulty of planting it owing to its long tap-root, but refers us to Elwes for the best method of culture, and the present number contains a paper by that writer on the black walnut.

Sir Herbert Maxwell's contribution to the knowledge of Forestry is a valuable addition to the "Encyclopædia of Agriculture." We can wish only that he had added more details as to the soils required by the different species he has referred to, a matter which agriculturists would certainly appreciate.

W. R. FISHER.

LIST OF BOOKS, JOURNALS, AND PAMPHLETS RECEIVED OR NOTED.

"Forest Entomology," by A. T. Gillanders, F.E.S. William Blackwood & Sons, Edinburgh and London.

"British Oak Galls," by Edward Connold, F.L.S., F.E.S. Adlard & Son, Bartholomew Close, London, E.C. (10s. 6d.).

Publications of the United States Department of Agriculture.

Analysis and Grading of Creosotes, Circular 122, 27th February, 1908: see also Circular 98, 9th May, 1908; Control of Forest Fires at McLeod, California, Circular 79, 16th May, 1907; Experiments with Railway Cross-ties, Circular 146, 25th April, 1908; Forest Planting on the Northern Prairies, Circular 145, 20th March, 1908. Forest Products of the United States, 1906, Bulletin 77, 2nd March, 1908; Progress in Chestnut Pole Preservation, 27th April, 1908; Relation of the Southern Appalachian Mountains to Inland Water Navigation, Circular 143, 7th March, 1908; Ditto to the Development of Water-power, Circular 144, 20th March, 1908; Suggestions to Woodlot Owners in the Ohio Valley Region, Circular 138, 25th February, 1908; Tests of Vehicle and Implement Woods, Circular 142, 19th February, 1908; Yellow Poplar (*liliodendron tulipifera*), Circular 93, 29th April, 1907.

We hope to publish a review of Vol. III. of "Trees of Great Britain and Ireland," by Elwes and Henry, in our next number.

Current Topics and Short Notes.

THE report of the committee on Irish Forestry was published on the 6th April, together with a complete volume of the evidence and papers submitted to the committee. These may be obtained from His Majesty's Stationery Office, Dublin, or from Wyman & Sons, Fetter Lane, London, E.C., the price being 6*½*d. for the report and 4*s.* 5d. for the evidence, etc. The report has been received favourably in the House of Commons, and it is probable that Government will carry out the recommendations of the committee.

The report of the committee to recommend a scheme for training probationers for the Indian Forest Service was submitted to the India Office before Easter, but it has not been published yet. Meanwhile sixteen probationers, to be trained at Oxford, are to be appointed in July.

Professor Somerville, a Past-President of the Royal English Arboricultural Society, and Professor Fraser Storey, one of our councillors, are members of the Royal Commission on Coast Erosion, of which the Hon. Ivor Guest, M.P., is chairman. The Commission will consider also the question of the relationship of afforestation to unemployment. Mr. J. Galvin, of the Irish Forestry Society, is a member of the Commission.

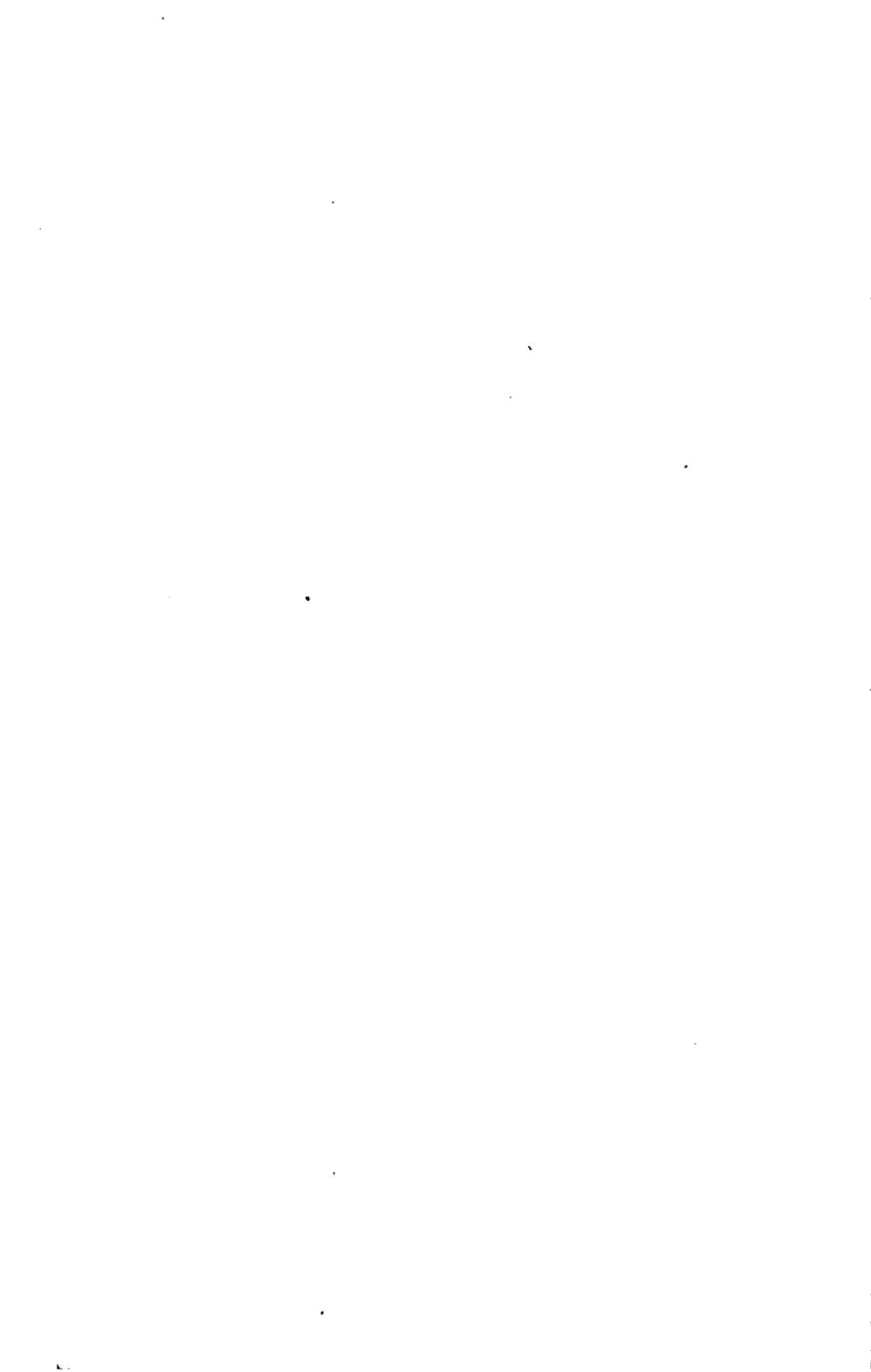
The annual excursion of the Irish Forestry Society was held on 27th June, Lord de Vesci having invited the members of the society to see his woods at Abbeyleix, in Queen's County.

LOCKERLEY HALL ESTATE, HANTS— PROPAGATING ELM.

NATURE is the best propagator. My experience for twenty-seven years is that where large elms are cut and carted away, the surface of the ground is broken up and the small roots broken off, they strike out at the ends and grow up into timber; the seed from the standing elms



WOOD NEAR LOCKERLEY HALL.



also germinates. The ground is loam mixed with coarse gravel. I intend raising trees by layers and cuttings, and have the ground broken up where there is no elm, so that the seed from the standing elm might be scattered by the wind on it, as the trees are so high, 110 to 120 feet high. The area of this wood is 20 acres, and it is divided into four cuttings, one of which is cut every ten or twelve years, this season four and a half acres being cut. The underwood is made up into hurdles, spars, etc., and about four hundred young elm left, of which I am sending photographs of four sizes of the growth of twelve, twenty-four, thirty-five years, and the large trees. This elm is a fortnight later coming into leaf, and quite different in leaf and appearance from what I have bought as wych-elm, with large leaves and very branchy. This elm timber has been sold always for wych-elm. It is of good length, clean, straight, and well-coloured, and meets with a ready sale, realising a shilling per cubic foot. I have on record for seventy years that a great many fine elms have been cut, and give an account of a few that have been cut this year.

No.	Butts. Length in feet.	Mid quarter-girth in inches.	Tops. Contents in feet.
1	56	22 = 188 ft. 2 in.	
	10	12½ =	10 ft. 10 in.
	8	8 =	3 " 6 "
2	48	19½ = 126 " 8 "	
	27	12½ =	29 " 3 "
3	48	20½ = 140 "	
	20	13½ =	25 " 3 "
4	40	9 = 22 " 6 "	
	48	20 = 133 " 4 "	
5	12	13 =	14 " 1 "
	14	10 =	9 " 8 "
6	38	14 = 51 " 8 "	
7	56	10 = 38 " 10 "	
8	36	13 = 42 " 3 "	
9	28	19 = 70 " 2 "	
10	30	22½ = 105 " 5 "	
11	50	11 = 41 " 11 "	
12	50	15 = 78 " 1 "	
	22	12 =	22 "
		1,039 ft. 0 in.	114 ft. 7 in.

Butts at 1s. per ft. Tops, 9d. per ft.

The other species of elm, which had very fine butts, realised: butts, 10*d.* per foot; tops, 8*d.* per foot.

In Fishpond Wood I cut an ash, 75 to 82 feet length of bole, and containing 244 feet in one tree.

FRED ARTHUR.

THE NURSERY,
EAST TYTHERLEY, NEAR SALISBURY.

SOPHORA JAPONICA OR PAGODA TREE.

AT page 196 of the QUARTERLY JOURNAL OF FORESTRY mention is made of a *Sophora Japonica* in the botanical gardens at Oxford, 65 feet high, and one at Cambridge still finer. Both these trees are described, and the Cambridge tree figured in Elwes's and Henry's "Trees of Great Britain and Ireland." Being at Cambridge a short time ago, I hunted out this famous tree, which is certainly a magnificent specimen. It is growing in rather an obscure place, almost hidden by lofty buildings, in what is known as the old botanic or physic garden. Some extensive buildings were going on at the place, and I was fortunate to get the assistance of an obliging foreman, and we had the tree measured. At eighteen inches from the ground the girth is 15 feet, and at five feet up it is 11 feet round. The trunk, almost straight, is 25 feet, and the spread of branches 72 feet or thereabouts. The tree seems in the most perfect health, well-furnished throughout, and judging from the height of the adjacent houses the total altitude would be between 90 and 100 feet. No doubt the close proximity to the lofty buildings has materially helped to draw it up to its present remarkable height.

There are some fine trees about Cambridge, particularly elms and horse-chestnuts. There are also some good *Ailanthus*, or trees of heaven. One really excellent specimen, I noticed, had an iron rail deeply grown into it, but this could be removed with very little trouble if the owner were to receive a gentle hint to that effect.

LEAZES PARK,
NEWCASTLE-UPON-TYNE.

JOHN WILSON.

FALL IN GIRTH OF PINES AND LARCH.

As every practical forester knows, it needs much practice and eye-judgment to ascertain correctly the fall in the quarter-girth measurement of coniferous trees when they have to be measured standing, between the ordinary girth place, viz., 6 feet from the ground, to the correct measuring place, half-way up the stem of the tree.

I have often tested the measurements of trees when measured standing, and afterwards, when the same trees have been felled, and I have been surprised to find that the fall is greater than I expected, notably in the case of Scots pine. I was walking recently through Woolmer Forest, and was much struck by the clean cylindrical boles of the Scots pines there of about 85 years of age. I began to calculate the fall, and came to the conclusion that an allowance of 2 inches quarter-girth for it would be a fair estimate. On a subsequent visit, I found that some of the best trees had been felled and were lying where felled, so I took the measurements carefully of ten trees, not picked, but as they came, and was surprised to find that the fall in the quarter-girth averaged $3\frac{3}{8}$ inches as per measurements annexed.

Number.	Length.	Quarter-girth at 6 ft.	Quarter-girth Half-way up.	Fall.	Cubical Contents.	Remarks.
	Feet.	Inches.	Inches.	Inches.	Feet.	
1	40	19 $\frac{1}{2}$	15 $\frac{1}{4}$	4 $\frac{1}{4}$	65	
2	42	19 $\frac{1}{2}$	14 $\frac{1}{2}$	5 $\frac{1}{4}$	61	
3	32	17 $\frac{1}{2}$	16 $\frac{1}{4}$	1 $\frac{1}{4}$	58	
4	45	17 $\frac{1}{2}$	13 $\frac{3}{4}$	3 $\frac{1}{4}$	58	
5	50	15 $\frac{1}{2}$	11 $\frac{1}{2}$	4	44	
6	45	12 $\frac{1}{2}$	10 $\frac{1}{2}$	2 $\frac{1}{4}$	34	
7	44	14	10 $\frac{1}{2}$	3 $\frac{1}{4}$	35	
8	48	13	11	2	41	
9	50	16	12 $\frac{1}{2}$	3 $\frac{1}{2}$	54	
10	51	15 $\frac{1}{2}$	11	4 $\frac{1}{4}$	43	
				33 $\frac{1}{4}$	493	

Average fall, $3\frac{3}{8}$ in. quarter-girth.

As will be seen by the measurements annexed, the average fall was $3\frac{3}{8}$ inches quarter-girth, a much larger fall than would have been allowed for by most foresters.

There were also a few larch, but not enough to get ten average trees. A few were, however, measured, and were found to fall about 2 inches, and they were longer than the Scots pine, although not so large in girth. What a pity that this forest was not planted more extensively with larch in preference to Scots pine! If this had been done the present value of the crop of larch would have been at least twice as much as the crop of Scots pine.

G. MARSHALL.

"THE INDIAN FORESTER."

THIS excellent forestry magazine was started, with quarterly numbers, in July, 1875, Dr. Schlich being the first honorary editor. He was succeeded in 1877 by Mr. J. Sykes Gamble, then conservator of forests in Bengal, and in 1881 by the writer of this notice, then deputy director and subsequently director of the Dehra Dun Forest School when the magazine became a monthly publication, and has since so remained. Mr. E. E. Fernandez, then deputy director of the school, succeeded to the editorship in 1899, and several honorary editors have since held charge of the fortunes of this journal, the present one being Mr. P. H. Clutterbuck, F.L.S., who is now officiating conservator of forests at Nagpur. The *Indian Forester* has improved greatly of late, it is printed on thin paper, instead of the heavy, glazed paper that was introduced by Mr. Stebbing, which made a year's volume very unwieldy.

The subject-matter contained in the *Indian Forester* has also become more readable, as there are many valuable, original articles, and well-executed plates, for its circulation has increased and there are more funds than in its early days to pay for illustrations.

Considering the interest caused by the recent appointment of a committee to recommend measures for the future training of probationers for the Indian Forest Department, it is not surprising that some of the recent papers in the *Indian Forester* have referred to that subject, and that various opinions on it have been expressed. Some of these are editorials, others are signed articles; there are, however, a few writers, who

presume to criticise persons whom they mention by name, but without themselves signing their effusions. They have thus the advantage of an attack, in which they can make statements, without previously ascertaining whether or not they are correct; but they have the disadvantage that no one, including the persons they attack, can attach any importance to what they say. This mode of attack, which was initiated by "Observer," in September, 1906, was rebuked by the editor, Mr. Stebbing, in the succeeding December, but similar anonymous personal attacks were made in this year's February and March numbers, though the present editor disapproves of these anonymous contributions, but apparently is powerless to prevent them.

It is quite true, that the name of the Inspector-General appeared for the year 1906, as President of the Board of Management of the *Indian Forester*, a practice that is quite at variance with the object held in view since its foundation, namely, to afford a medium in which persons interested in Indian forestry might interchange opinions and communicate information regarding forest work. This object could not be realised when the name of the Inspector-General of Forests, who is known to have very strong opinions on many subjects and great determination in carrying them out, hung like a thunder-cloud over the columns of contents of each number of the Journal. The Inspector-General, however, recognised what was wrong, and withdrew from the Board of Management, though the anonymous papers are continued.

There is surely independence enough among the contributors to the Journal to enable them to sign their names fearlessly to their contributions, and if incognito is desirable, it can be secured by editorials, when the editor, for his own sake, will see that the matter is such, that it can be supported by evidence, which he, at any rate, considers sufficient.

About forty Indian forest officers home on leave, or already retired from the service, who wish to show their full appreciation of Dr. Schlich's work in connection with the training of probationers for the Indian Forest Department and the position he has taken with regard to their training in the future, have invited him and Mrs. Schlich to a dinner in London, on the 13th July.

SALES OF TIMBER.

Colesborne, near Cheltenham.—Prices realised during 1907–08.

Measured by string, quarter-girth, Hoppus measurer, 1 inch per foot allowed for bark. Trees felled by vendor, mostly near road, 7 to 8 miles from station.

Oak, not coppice grown	...	...	...	...	1s. 6d. per ft.
Ash	"	...	...	...	1s. 6d.
Elm, good quality	"	...	...	...	9d. to 10d. per ft.
Elm, 50 years old; average, 40 ft. per tree	...	...	...	...	8d. per ft.

This last was a very fast-growing variety, budded on stocks of wych elm, very inferior in habit, and also, I think, in timber, to true English elm, which should be grown always from suckers; but, if the trees are carefully pruned to prevent them from splitting, it may pay as well at the above price.

Horse-chestnut	...	...	...	...	9d. per ft.
	(discoloured)	...	...	...	6d. "
Alder	"	...	...	...	6d. "
Larch, average 15 to 20 ft.	...	...	...	...	9d. to 10d. per ft.
Spruce, 70–75 years old, about 40 ft. average, close to road	...	...	...	...	6d. per ft.

These spruce had begun to decay at heart where they were at all crowded, and from 2 to 5 feet had to be allowed off the butts of many of them. The total yield for about an acre was under 2,000 feet.

COLESBORNE, CHELTENHAM.

H. J. ELWES.

Wiltshire.—The following are current prices obtained for timber in this neighbourhood. Earlier in the season trade was brisker, but at present timber of all kinds, even of first-class quality, is hard to market, and oak is almost unsaleable.

The measurements are taken up to 6 inches diameter, and 1 inch per foot, quarter-girth, is allowed for bark.

Beech	1s. to 1s. 2d. per ft.	Easy of access, close to good roads, and within 3½ miles of a railway station.
Oak	...	...	1s. 4d. to 1s. 6d. per ft.
Ash	...	...	1s. 6d. to 1s. 8d. "
Elm	...	...	9d. to 1s. "

Underwood in this district is practically unsaleable. As an instance, recently we have been obliged to give away for the

cutting the underwood in a wood of 15 acres, chiefly ash and alder, which twenty years ago made £90.

BOWOOD, CALNE, WILTS.

WM. FORGAN.

East Yorkshire.—The timber on this estate is sold by tender and felled by piecework. That the cutters are paid for the same amount put up for sale is a guarantee of the authenticity of the measurements. All the hardwoods in the following list were sold butts and limbs together, the oak being well topped—down to 8 inches diameter or more—as sometimes a better figure can be made of the main part (occasionally as much as 2d. or 3d. extra per foot) by taking off rather more of a rough top. These tops are used on the estate for fencing, and are, as a consequence, of good value to us.

In measuring the larch, $\frac{1}{4}$ inch in the quarter-girth is allowed for bark, and $\frac{1}{2}$ inch in the case of the hardwoods. All limbs are cut out to 4 inches diameter at top. Sold lying in wood.

Kind of tree.	Quarter-girth.	Cost of leading to station.	Price obtained per ft.	Remarks.
Larch . . .	7 $\frac{1}{4}$ in. to 12 in.	2d.	11 $\frac{1}{2}$ d.	Long, clean and sound.
" . . .	6 in. to 7 in.	1 $\frac{1}{2}$ d.	9 $\frac{1}{2}$ d.	Straight, "
" . . .	Poles, 6 ft. aver.	2d.	6d.	
Scots Fir . . .	Above 6 in.	2d.	4d.	
" . . .	Under 6 in.	2d.	3d.	
Beech . . .	16 in. and up.	1 $\frac{1}{2}$ d.	1s.	Clean and round.
" Tops . . .		3d.	6d.	Very rough and fluted.
Sycamore . . .	6 in. to 12 in.	1 $\frac{1}{2}$ d.	7d.	Bobbin wood.
Ash . . .	14 in. to 32 in.	1 $\frac{1}{2}$ d.	1s. 4d.	Blackhearted, but sound and hard.
" . . .	6 in. to 12 in.	1 $\frac{1}{2}$ d.	1s.	White, sound and good.
Oak (peeled) . . .	7 in. to 12 in.	1 $\frac{1}{2}$ d.	1s.	Short and rough, not a good class.
" . . .	12 in. to 20 in.	4d.	1s. 10d.	A first-class lot. Long, clean, and free from shakes. Rather more than half would pass the inspector for wagon soles.

Oak peeling is just commencing (May 13th), but in this district is scarcely worth the trouble. Last year we could make only 63s. per ton of 20 cwts., chopped and bagged, free on rail. Even at that price sellers were begging for customers, and appearances are, so far, not much brighter this season.

A. McDougall.

DUNCOMBE PARK, HELMSLEY, YORKS.

Darlington District.—Following are particulars of the sales of timber on the Raby Castle Estate. Prices are somewhat similar to those realised for the past few years.

Kind.	Quarter-girth.	Length.	Quality.	Distance from station.	Price.
1. Ash .	16 in.	36 ft.	Good.	3 miles.	15. 3d.
2. " .	26 in. to 9 in.		Fair.	"	6d. to 8d.
3. " .	22 in. to 6 in.		"	To Sawyard. 6 miles.	1s.
				From station.	
4. Beech .	30 in. to 13½ in.	7 ft. to 40 ft.	Good.	5 miles.	6d.
5. Wych Elm	18 in. to 12 in.	6 ft. to 16 ft.	Fair.	5 "	7d.
6. Oak .	20 in.	12 ft. to 14 ft.	Good.	5 "	15. 9d.
7. " .	11 in. to 20 in.	6 ft. to 30 ft.	Fair.	6 "	1s.
8. Sycamore	7 in. to 14 in.	9 ft. to 20 ft.	Fairly Good.	5 "	8d.
9. Poplar	16 in.	20 ft. to 40 ft.	Good.	2 "	9½d.

REMARKS.—Sold felled, in plantation. Butts only. 1 in 12 allowed in girth. 2. Sold standing, hedgerow. Butts only. 1 in 12 allowed in girth. 3. Sold standing, plantation. Butts only. 1 in 12 allowed in girth. 4. Sold topwood, 6d. per cub. ft. Sold standing, plantation. Butts only. 5. Sold standing, plantation. Butts only. 1 in 12 allowed in girth. 6. Sold standing, plantation. Butts only. 1 in 12 allowed in girth. 7. Sold standing, grown open in fields. 1 in 12 allowed in girth. Sold standing, tops, 6d. per cub. ft. 1 in 12 allowed in girth. 8. Sold standing, plantation. Butts only. 9. Sold felled, plantation. Butts only. 1 in 12 allowed in girth.

The quarter-girths are shown after being reduced 1 in 12. This system of reduction I do not like. All buyers and sellers ought to agree mutually to take the full girth and fix prices accordingly.

I would like to hear from my brother foresters whether the young larch in their respective neighbourhoods have suffered from the effect of last year's October frost. We have in some quarters suffered most severely here at Raby. I noticed at the time of the frost how the tender shoots had suffered, but never thought that the damage would be so severe. I think the reason why the trees have been damaged is due to the fact that, owing to the cold early-summer, growth was retarded, then, when the weather became warmer in September, growth was stimulated to an abnormal degree; consequently, when we got the early frost the tender and unmatured growth was unable to stand the sudden change.

THOS. BEWICK,
Head Forester.

RABY CASTLE, DARLINGTON.

Worcestershire.—The demand for most kinds of home-grown timber has been well-maintained during the past season in this district, and prices have shown a slightly upward tendency, good oak, ash, sweet chestnut, English elm, and larch especially being much sought after. The following are the prices of several lots sold recently on Witley Court Estate:—

LOT 1.

No. of trees.	Kiad.	Total cubic contents.	Price per ft.	Remarks.
115	Larch	1,667 ft.	10d.	Good quality.
31	Sp. Chestnut	1,982 "	10d.	No ring-shake.
23	Oak	1,065 "	1s. 6d.	Coppice grown.
29	Ash	903 "	1s. 6d.	Coppice grown, good boles, numerous tops.
20	Birch	98 "	6d.	

Close to a good road, about 6 miles from railway.

Sales of Timber.

LOT 2.

No. of trees.	Kind.	Total cubic contents.	Price per ft.	Remarks.
28	Beech	903 ft.	9d.	From 11 to 16 in. quarter girth, good boles.
29	Sycamore	492 "	8d.	From 7 to 12 in. quarter girth, rough.
5	Oak	143 "	1s. 6d.	Fair quality.
119	Ash	1,608 "	1s. 6d.	Grown from old coppice stools, poor quality.
95	"	454 "	1s.	Grown from old coppice stools. Below 6½ in. quarter-girth.
5	Larch	107 "	10d.	
41	Spruce	503 "	6d.	Very rough.

Adjoining good road, 7½ miles from railway.

LOT 3.

No. of trees.	Kind.	Total cubic contents.	Price per ft.	Remarks.
369	Oak poles	1,440 ft.	7d.	Rough coppice-grown poles, used locally as pit-wood.

LOT 4.

No. of trees.	Kind.	Total cubic contents.	Price per ft.	Remarks.
29	English Elm	1,719 ft.	11d.	Hedgerow timber.
12	Ash	330 "	1s. 7d.	" "
13	Oak	627 "	1s. 8d.	" " good boles.
2	Poplar	427 "	9d.	

This lot also close to a good road, 7 miles from railway.

All the above timber was measured with quarter-girth tape over bark, and all limbs and tops down to 6 inches quarter-girth are included in the foregoing measurements and prices.

J. B. BRAID.

Official Notices.

THE Publication Committee of the *Quarterly Journal of Forestry* is as follows:—

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As the Journal is published on the 1st of January, April, July and October any papers intended for publication should be sent either to the Chief Editor, or to one of the Sub-Editors, before the 15th day of the month preceding publication of any Number.

Copies of this Journal and of back numbers may be obtained from the publishers, Simpkin, Marshall, Hamilton, Kent & Co., Ltd., 23, Paternoster Row, London, E.C.

TUBNEY ARBORETUM.

THE Arboretum at Tubney is supported by the sale of plants from an adjoining small nursery, where also the few plants required for stocking the arboretum are grown.

The following plants are now for sale from this nursery:—

Beech, 3 years (1—2) ...	...	...	...	...	...	2,000
Beech, 4 years (1—3) ...	...	...	...	...	...	6,000
Sessile oak (from Norway), 3 years (1—2)	...	...	...	...	...	2,500
Douglas fir, Pacific (very fine), 3 years (1—2)	...	...	...	...	...	6,500
Douglas fir, Pacific (smaller), 3 years (1—2)	...	...	...	...	...	2,500
Larch, 3—5 years ...	...	...	...	...	...	6,000
Larch, 1 year's seedlings (very fine)	...	...	...	...	...	40,000
Corsican pine, 3 and 4 years ...	...	...	...	...	...	7,000
Corsican pine, 2 years' seedlings ...	...	...	...	...	...	40,000
Scots pine, 2 years' seedlings ...	...	...	...	...	...	20,000
Tsuga mertensiana, 3 years ...	...	...	...	...	...	1,500
Thuga gigantea, 3 years ...	...	...	...	...	...	3,000

Samples will be sent, on application to the Bursar, Magdalen College, Oxford, with whom the prices of the plants can be arranged.

A local meeting of the R. E. A. S. will be held at Dipton Woods, Corbridge, on the 10th October next. Those wishing to join should write to the secretary.

ERRATA TO JULY NUMBER.

In "Official Notices," line 20, *for Assistant Secretary read Secretary.*

Page 203, line 23, *for Eryptomeria read Cryptomeria.*

Page 204, line 12, *for Willkommi read Willkommii.*

Page 209, line four from bottom of page, *for Liliodendron read Liriodendron.*

CONTENTS.

ORIGINAL ARTICLES :—	PAGE
The Russian Larch. By H. J. Elwes	221
Working Plan of Stisted Hall Woodlands, 1907—1922. By W. R. Fisher	224
Notes on the Forests of Switzerland. By Julien Morel	245
Fencing. By J. C. Archibald	250
School of Forestry. Royal Forest of Dean. By C. O. Hanson	263
Planting and Reclamation of Moors and Bogs in Belgium. By A. P. Grenfell	267
OBITUARY NOTICE :—	
Mr. F. B. Manson	283
REVIEWS AND NOTICES OF BOOKS :—	
Stebbing's Indian Forest Zoology. By Ed.	285
Mathey's "Commercial Utilization of Wood," Vol. II. By Ed.	288
The Crown Plantations at Oxshott, Surrey. By E. P. P.	290
Evelyn's "Sylva." Nisbet's Edition. By Ed.	292
Connold's "British Oak Galls." By Ed.	297
OFFICIAL PAPERS :—	
Notes on Past and Present Condition of some of the Woods, and the General Plan of Management of the Hargham Estate, belonging to Sir H. Beevor, Bart. By H. B.	298
The Forestry Exhibition at Newcastle-on-Tyne. By A. C. Forbes	303
Royal English Arboricultural Society. By E. Davidson	307
Acorns for Denmark. By H. J. Elwes	308
Seeds of Palm (<i>Livistona sp.</i>). By A. Smythies	308
CURRENT TOPICS AND SHORT NOTES :—	
List of Forest Probationers sent to Oxford. By Ed.	309
Purchase of Woods by Irish Agricultural Department. By A. C. F.	310
Chestnut Coppice, near Paris. By P. M. Leddet	310
Forestry in South Australia	311
Sequoia Wellingtonia Felled at Brocklesby Park. By W. B. Havelock	312
Maraby Woods, North Lincolnshire. By W. B. Havelock	313
Note by Prof. Boulger on Review on "Wood"	314
TIMBER SALES	315
List of Books, Journals and Pamphlets received, announced or noted	316





[Photo.]

RUSSIAN LARCH AT RAIVOLA.

[W. R. Price.]



Quarterly Journal of Forestry.

No. 4.]

OCTOBER, 1908.

[VOL. II.

Original Articles.

THE RUSSIAN LARCH.

ON page 376 of the "Trees of Great Britain and Ireland" I gave a short account of a plantation of larch which was made at Raivola in Finland, between the years 1750—1760, by a German forester named Fockel, with seed which, according to Schwappach,* came from Archangel; but according to Mayr,† from Ufa, in the Southern Ural. Having recently visited this very interesting plantation in company with Messrs. M. P. and W. R. Price, I think further details may be useful, as though the failure of this species to grow well in England has been general, yet it may be a more useful tree for those parts of North America and Europe where the summer is shorter than in England.

Raivola is about two hours by the Finland railway from St. Petersburg, and on arriving we found the forest guard, a very civil Finn, named Antti Pitkamuni, who speaks Swedish, ready to show us round. The forest is not a large one, and of its total area only about 75 acres are planted with pure larch, which area, according to Schwappach, contains about 8,500 trees. They were planted originally in somewhat irregular rows, 10 to 12 feet apart, on ground which is of

* Schwappach, "Forstliche Reisebilder aus Russland." Berlin, 1902, p. 6.

† Mayr. "Fremdländische Wald u. Parkbaume für Europa." Berlin, 1906, p. 313.

variable depth and quality, but mostly a sandy loam of the same character as that on which spruce grows well in many parts of Norway. A good many spruce, birch, and mountain-ash, and a few pines, have sprung up from self-sown seed; but we could not find a single self-sown larch in the forest, though on a barren piece of ground outside it, on which a poor stunted larch grew alone, a number of self-sown seedlings from it were found. Schwappach accounts for the absence of natural seedlings by cattle-grazing and theft, but I attribute it rather to the want of light under the tall trees.

The average height of the mature trees appeared to be at least 100 feet, two of the tallest, which I measured carefully, being 113 feet by 5 feet 4 inches and 120 feet by 5 feet 4 inches respectively; the thickest that I could find was 6 feet 5 inches at 8 feet from the ground. Many of them were clean to 60 to 70 feet up, but where the branches had not fallen they seemed to remain undecayed for a longer period than in the common larch.

As to the quantity of timber per acre, it was difficult in the time at our disposal to make an accurate estimate, but I think, that the one quoted by Schwappach as having been made by Professor Erichson in 1897 is now much too high, and, as Mayr says, that a number of trees were blown down shortly before his visit, the difference in number may explain this partially.

Erichson counted on one hectare 402 trees estimated to contain 951 feet metres, which Professor Somerville works out at 10,968 cubic feet, English measure, per acre.

I estimated about 100 full-sized trees to the acre, of which 50 of 100 feet by 9 inches quarter-girth equalled 56 feet each, 50 of 75 feet by 9 inches quarter-girth equalled 44 feet each, 35 of 60 feet by 7 inches quarter-girth equalled 20 feet each, plus 30 to 40 undersized or partially suppressed trees, say total 5,700 feet per acre. Now if we take the number per acre at 150, and the average contents at 50 feet, which I believe is the very outside that a practical valuer would allow, we have 7,500 cubic feet per acre.

Mr. Price took the girth of fifty-one trees on an area of 40 yards square and found that they averaged $4\frac{1}{2}$ feet at breast height.

From the butt of a tree which had been blown down recently, the forester was good enough to let me take a section about 1 foot in diameter, of which the red heartwood was about $9\frac{1}{2}$ inches in diameter, and the white sapwood only $\frac{1}{4}$ inch in thickness. The bark was about 1 inch thick.

In the period from about twenty to thirty years old the tree had made its most rapid growth, measuring $2\frac{1}{2}$ inches on the radius; in the next twenty years only $1\frac{1}{4}$ inches, and after fifty years the rings were so close that I could count them only with difficulty, and with the help of a strong lense.

It is thus evident that the tree is—in this climate at least—an extremely slow grower, and that if planted for profit its longest rotation should not exceed 100 years. I may add that, in logs imported from Archangel, the growth was more rapid and the difference in colour of heart and sapwood much less than in this specimen, which I have presented to Mr. Henry for the Cambridge Museum. A plank from a tree in this forest was shown at the Paris Exhibition in 1900, and described by Professor Mayr.

Close to the forester's house was a small nursery, in which seven-year-old plants were already 6 to 12 feet high and making leaders 1 to 2 feet long; eleven-year-old trees in the same place were 15 to 18 feet high, and bearing cones. These are distinctly different in shape, as described in our work, from those of the European larch.

The bark is, however, very similar, and strikingly different from that of the Dahurian larch, which, as grown in the St. Petersburg Botanic Gardens, has bark much more like that of a spruce. The difference is well shown in Plate 100 of "Trees of Great Britain and Ireland," from a tree of the Dahurian larch at Woburn.

I have no exact information of the climate of Raivola, which lies close to the sea on the Gulf of Finland, but on a previous visit to Imatra, which is not far off, I found the spring at least a month or six weeks later than in England. The summer is warm enough to ripen rye and oats, but not wheat. The autumn sets in early, a frost sharp enough to blacken the leaves of potatoes having occurred on the morning of our visit, August 22nd, and the seedling larches had already ripened their

buds. The winter is long and cold, but liable to thaws, and the climate much damper both in summer and winter than that of Archangel and the Ural mountains. No trace of *Peziza* was found, but a few *Chermes* were noticed on young trees in the nursery. I may add that this species seemed to be growing very vigorously in a young state at Berlin, and is also successful on the coast of Norway, just within the Arctic circle.

It is possible that seedlings raised from trees at Raivola may be more successful in Great Britain than those brought from Archangel, and this I hope to try next season. But having now cultivated and seen in its native country every known species of larch, except the larches of North China and Kamschatcha, I firmly maintain the opinion that I have previously expressed, namely, that none will be found to supersede the European larch as a profitable timber tree in Great Britain, and that we must therefore seek to combat the disease by careful selection of seed, and by more careful cultivation on suitable land only.

H. J. ELWES.

WORKING-PLAN OF STISTED HALL WOODLANDS, 1907—1922.

By W. R. FISHER.

PART I.—GENERAL DESCRIPTION OF THE LOCALITY.

THE Stisted Hall estate, 3391 acres in extent, is the property of Mr. C. S. Montefiore and is situated on a knoll of rising ground surrounded by a more or less flat plateau. The mansion, Stisted Hall, is two miles from Braintree, a busy manufacturing little town, and five miles from Coggeshall, and three miles from Halstead. The estate is traversed from west to east by the small river Blackwater, which frequently floods the fields on either side of it. The village of Stisted adjoins the Hall. The altitude above sea-level varies from 252 feet near Mott Wood to 100 feet at the south-east near Blackwater bridge.

There is an excellent ordnance map, on which all the woods are marked. A separate tracing should be made showing

the woods coloured green, with their names and numbers. This should also show the Hall, gardens, and park, and other buildings, farms, etc., and roads, but the numbers of the fields should be omitted. The river and any ponds should be coloured blue. Any fresh lands, that it is intended to plant, should be shown on the map and coloured pink. A list of the woods, with their numbers and areas, may also be given on the margin of the map. Such a woodland map will facilitate forest work, and the woodman should be supplied with a copy of it.

(a.) *Geology and Soil.*

All lower lands on the estate are situate on the London clay, and on alluvial gravel above this. The knoll around Stisted Hall is composed of boulders, glacial sands and gravel.

The soil on the higher land is a sandy and gravelly loam, but on the lower land it is a more or less stiff clay, or clayey loam containing only a few pebbles. As the woodlands are old the soil in them has been greatly enriched by humus from dead leaves, branches, etc. Its upper layers are consequently much more friable than the soil on adjoining farmland. This improved soil will, however, speedily deteriorate if rabbits are allowed to destroy the underwood, as they are doing in the recently felled woods. The cover of the underwood is thus destroyed and the sun breaking on the unprotected soil soon disperses the humus and dries the land, its action in this respect being increased by that of the wind that gains admission as soon as the underwood becomes thin. The permeability of the soil to the roots of trees also becomes reduced by the beating of the rain on the unprotected soil, which will thus become similar physically to that of the farmland, while the absence of culture on woodland soil will render it much stiffer and more subject to waterlogging than adjoining ploughed fields. As long as a dense crop of underwood is maintained none of these defects can arise, and, as already stated, the woodland soil is still for the most part in admirable condition, excellent for producing oak, ash, sycamore, sweet chestnut, and larch. It is therefore the interest of the owner to maintain this high condition of the soil, which can be done only by the complete destruction of rabbits.

226 Working-Plan of Stisted Hall Woodlands.

(b.) *Area.*

There are 149½ acres of woodland, exclusive of the ornamental woods round Stisted Hall. There is a proposal to plant some more land with larch and willows.

(c.) *Game.*

The estate is well-stocked with pheasants, partridges, and a few hares. Were the rabbits destroyed there would be more hares. A sheet of ornamental water harbours wild-ducks. Woodcock also occur, and there is suitable land for snipe. The estate is greatly overstocked with rabbits, and unless they are kept down, any improvement of the woods is impossible except at the cost of wire-netting all the woods, that is very costly.

When the present fine undergrowth was cut, fourteen to sixteen years ago, the keepers were paid low wages and supported themselves partly by selling rabbits, and consequently they kept them down, as the wholesale destruction of underwood that now occurs after every felling could not then have happened, or the old underwood would not be so tall and dense.

At present, not only are the young coppice-shoots being destroyed, but the tenants are fencing their young wheat and crops with wire-netting. I know of estates in Surrey where excellent soil is reduced to producing nothing but moss and lichens, owing to the grass being destroyed completely by rabbits, yet the old trees standing above the former meadows are fine and tall and show that these conditions are quite recent.

Foxes are the greatest enemies of rabbits, and although their presence is hostile to pheasants the provision of a few spruce trees in the coverts for the latter to perch upon, and special care of young pheasants, can protect them sufficiently against foxes. The fine gamey flavour of pheasants twenty years ago has disappeared now that they have no enemies to make them somewhat wild, the great superiority of partridges in this respect being due to their still being wild birds.

(d.) *Meteorology.*

No data having been given me of the local meteorology, this part of the subject must be written when data are available.

(e.) *Timber Markets and Facilities for Transport of Woodland Material.*

The estate is intersected with excellent roads, but there can be no doubt that the provision of good metalled roads leading from the woods to the public roadways greatly improves the prices of timber and firewood. I have known cases where the construction of a few miles of metalled road has doubled the price of woodland produce. It would therefore be advisable here to examine the woods carefully in order to improve their accessibility to traffic. A fixed sum of money spent annually on this object will have lasting effects on the revenue from the woods.

The custom here is that the trees and underwood are felled and converted before sale. If due care is taken and piecework adopted as much as possible, this work can be done as economically as by a purchaser, while, when the cutting is done by a careful and experienced man like the present woodman at Stisted Hall, the work is executed much more carefully than by a purchaser, who is apt to damage saplings and standing trees.

Much of the timber is used on the estate, and as there are thirty farms with their buildings and many miles of fencing to be kept in repair, this is the best use to make of it. All timber not required for the estate is sold. It is advisable to keep up a Forest Book, in which all revenue obtained from each wood is entered separately. The quantity of timber used for estate purposes also should be shown in this book, with its estimated value. Otherwise the real value of the woodlands to the owner cannot be perceived, and there is always the fear of proper expenditure on the woods being curtailed unless the full revenue they produce is shown clearly, both in volume and value.

Oak and ash sell at about 1s. 6d. a cubic foot, elm at 6d., larch is fully worth 1s. a foot, but is all used on the estate. Some maiden willows have been sold at over 10s. per cubic foot. Essex is renowned for its willows, used for cricket-bats, which mature in twenty-five years from the date of planting. Sir W. Gilbey has recently sold willows at 7s. 6d. per cubic foot. Only the Huntingdon willow (*Salix viridis*) should be planted. Sycamore of large size is a most valuable wood, as much as 3s. 6d.

per cubic foot being paid this year—and I have heard of even higher prices being obtained.

The underwood is made up into hurdlewood, selling at 11s. per hundred; peasticks at 3d. a bundle, birch bundles at 6d.; poles at 11s. per hundred, faggots at £5 per thousand, stacked and carted by purchaser; thatching bundles at 8d. each. Excellent firing material is prepared at Oxford and sold to householders at five bundles for one penny. This is done by the Oxford Firewood Company. Five bundles weigh 3 lbs., and each bundle is made up of two or three split pieces, with the rest mere brushwood. Owing to the enormous quantity of kindling material required in London, there is certainly a good field for such a company at Braintree, and experience at Oxford shows that the neighbouring landowners find no difficulty in selling all their inferior underwood to the company above-mentioned.

It is stated that the underwood here yields £3 10s. per acre, after paying the cost of converting and felling, and this for fourteen years growth is 5s. per annum for each acre. This is irrespective of the value of the standards, from which the chief revenue of these woods should be anticipated.

Braintree is a flourishing industrial town, and there is a railway connecting it with the two main lines of the Great Eastern Railway—at Bishop Stortford and Witham—so that the sale of any large timber not required for estate purposes is assured.

PART II.—GENERAL ACCOUNT OF THE WOODS.

The detailed description of all the woodland compartments is given at the end of this report.

Except for a small area stocked with larch in compartment No. 5, Greenland Spring, the woods are all coppice-with-standards, the ornamental woods round the Hall being excluded from the present section of the working-plan.

The chief species of standard grown is oak, which flourishes on the soil above the London clay and attains large dimensions, yielding timber of first-rate quality. The largest oak on the estate is near South Lodge. Its girth is 17 feet at chest height, and it contains about 140 cubic feet. This is

merely an ornamental tree, but its life may be prolonged if the road were altered so that its roots are no longer driven over.

I measured two fine oaks in the woods; the first is in Lyon's Hall Wood (No. 13) and is 9 feet in girth and contains about 70 cubic feet. As it is now fully mature, it should be felled and its value realised. I can understand old oaks being kept up after they are fully mature, in parks and ornamental grounds, but in regular woodlands it is better to fell them when they are mature. An immense amount of valuable oak timber is allowed to rot in Great Britain on account of the neglect of this measure. The owners consequently lose revenue, and there is a loss to the country in valuable oak timber having to be imported and in the labour which their felling and conversion affords to the country.

I measured two sections of oaks lying in the timber-yard, near Stisted Hall. The rates of growth are given below:—

Inches in Radius.	No. of Rings.	No. of Rings.
1	8	8
2	11	6
3	9	7
4	10	6
5	9	5
6	11	6
7	11	6
8	14	8
9	17	6
10	13	7
11	13	5
12	16	6
13	—	8
14	—	6
15	—	4
16	—	6
17	—	4
Total -	140	104

230 Working-Plan of Stisted Hall Woodlands.

There is a great difference in the rates of growth of these two trees, and in order to ascertain the average rate of growth of oak at Stisted further measurements should be made after any standards have been felled, and they should from time to time be entered in the margin of this report. No. 1 oak attained a diameter of 2 feet, under bark, in 140 years, and No. 2 a diameter of 2 feet 10 inches in 104 years. If we allow 1 inch diameter for the bark, this would give girths of $6\frac{1}{2}$ feet and of 9 feet in the corresponding periods, the latter being an unusually rapid rate of growth.

Besides oak; elm, ash and sycamore attain large dimensions here. Measurements of these trees and countings of their rates of growth should be made whenever any trees of these species are felled, and the results recorded in the working-plan.

Only a few conifers are growing here; larch thrives and is apparently free from disease. There are some fine larch poles 60 feet high and 2 to 3 feet in girth, at chest-height, in No. 5, Greenfield Spring. They are said to be about forty-five years old. When one of these poles is felled, its exact age and the rate of growth should be ascertained and recorded here. The quality of the larch wood, as seen in the timber-yard, is excellent. This little clump of larch has for years yielded excellent fencing material for the estate. The area under larch should be increased considerably on the estate, and it may be grown as standards over coppice, as well as planted, and eventually underplanted with beech, to form high forest, on suitable land.

Silver-fir also grows well on the clay and loamy soil; it may in future be used to underplant the ornamental woods that consist chiefly of oaks, sycamore, and beech. It is best to use *Abies grandis* for this purpose.

As underwood; sweet chestnut, ash, and hazel grow admirably, the two former attaining heights of 25 feet in fourteen years, which is the usual period of rotation for underwood here.

The above are the principal forest trees at Stisted, but maiden willow is so valuable and grows so well on wet soils here, that it is advisable to assign a special area for its pro-

duction, as it is out of place in the ordinary coppice-with-standard woods.

There are some fine elms in No. 8, Alderwood, but the agent says that elmwood sells at only 6d. per cubic foot and is difficult to remove. As this tree affords such excellent material for wheelwright's work, and grows so straight and tall over underwood, I am inclined to advise the planting of a limited number of English elm saplings, after a felling. The great rapidity with which this tree puts on girth renders it an exceptionally valuable standard.

The same may be said of the grey and white poplars, provided a good price is obtainable for them. One of the chief advantages of the system of coppice-with-standards is that it is so easy to introduce new species whenever the coppice is cut. Black walnut is another valuable species that may thrive well over underwood.

As regards the distribution of the woodlands, most of them are in the north and north-west of the estate, where Mott and Stable Woods, Lower and Leafy Woods, and Lyons Hall Wood form fine blocks. It is now proposed to plant the plot of about 8 acres between Lower and Leafy Woods, and also to plant with larch the 12 acres of rising ground above No. 16, the Boathouse plantation. This would supply a fine wood in the south of the estate. Another area, not fixed at the time of my visit, is to be planted with willows.

As it may be desirable to plant some other areas, and as all such areas should be shown on the map and entered in the list of woodland areas, I am leaving a blank page in the working-plan for their inclusion.

The plot of 8 acres, to which a name should be assigned, should be strongly wire-netted and planted with ash and sweet chestnut for underwood, 5 feet apart, interspersed with 100 oak saplings and 100 larch plants. The latter and some of the ash will serve as standards, and the rest of the ash and sweet chestnut will be cut back in 1909-10-11.

The larch area above the Boathouse plantation also should be fenced strongly and wired, and should be planted with pure larch, 4 feet by 4 feet, but with belts of Corsican pines wherever danger from wind is feared.

232 Working-Plan of Stisted Hall Woodlands.

When this wood is twelve to fifteen years old the plantation should be thinned and underplanted with beech, as this species improves the growth of larch greatly, and prevents it from becoming diseased.

It will be seen that there is no proper sequence in the age-classes of the woods, some of them being too large and others too small. This is due to dictation of the time of felling by gamekeepers, who, without any knowledge of, or proper consideration for, the well-being of the woods, practically dictate as to where the fellings in any year are to be located. In future, it is advisable that after the owner of the land has decided to carry out this working-plan, and has approved of the proposed distribution of the fellings, that the regular sequence of fellings in the underwood should not be interfered with.

It will be quite possible to do this without in any way interfering with the shooting coverts, as will be seen hereafter.

LIST OF WOODLANDS.

No.	Name of Wood.	Area. Acres.	No. of falls.	Age in Autumn, 1906. Years.
1.	Stable wood	8	2	1, 14
2.	Mott wood	38	7	1, 5, 6, 8, 10, 14, 15
3.	Corner piece	1	1	15
4.	Broadfield wood	4	1	8
5.	Greenfield spring	3½	1	14
6.	Braintree wood	5	1	16
7.	Clapgate wood	6	2	5, 6
8.	Alderwood	3½	2	10, 12
9.	Leafy wood	12	2	1, 2
10.	Lower wood	26	5	2, 4, 5, 9, 10
11.	Bramble wood	4	2	4, 5
12.	Middle wood	3	1	3
13.	Lyons Hall wood	18	3	2, 8, 11
14.	Covens wood	9	3	2, 9, 10
14a.	Rectory piece	1	1	7
15.	Jenkins ashground	1	1	2
16.	Boathouse plantation	2	1	16
17.	Lake plantation	2½	1	3
18.	Worlds end (two pieces)...	1½	1	13
19.	Bay tree farm plantation	2	1	4

Total area, 149½ acres.

A separate list can be made of the new areas to be planted on page 12. The distribution of the woods as regards the ages of the underwood is given in the next tabular statement.

1 year. No. acres.	2 years. No. Acres.	3 years. No. Acres.	4 years. No. Acres.	5 years. No. Acres.	6 years. No. Acres.
1 4	9 7	12 3	10 6	2 6½	2 6½
2 3	10 5	17 2½	11 2	7 3	7 3
9 5	13 6		19 4	10 5	
	14 3			11 2	
	15 1				
Totals 12	22	5½	8½	16½	9½
7 years. No. Acres.	8 years. No. Acres.	9 years. No. Acres.	10 years. No. Acres.	11 years. No. Acres.	12 years. No. Acres.
14a 1	2 7½	10 5	2 6½	13 5	8 2
	4 4	14 3	8 1½		
	13 7		10 5		
			14 3		
Totals 1	18½	8	16	5	2
13 years. No. Acres.	14 years. No. Acres.	15 years. No. Acres.	16 years. No. Acres.	Grand Total:—	
18 1½	1 4	2 4	6 5		
	2 4	3 1	16 2	149½ acres.	
	5 3½				
Totals 1½	11½	5	7		

As regards the quality of the woodlands in the number and distribution of the standards, and height, growth, and density of the underwood, as well as its species, the chief points noted here are—

(1.) That the standards, though frequently numerous, are not sufficiently well-distributed in point of age. The following age-classes per acre should be found in a normal coppice-with-standards with fourteen years' rotation :

Old standards, four rotations and more ...	...	3
Middle-aged standards, three rotations ...	...	5
Young standards, two rotations ...	...	12
Tellers standards, one rotation ...	...	20
Saplings planted at last felling ...	...	50
	Total ...	<u>90</u>

If the standards on any measured acre at Stisted are counted it will be found that the younger age-classes are very deficient. This is due to the absence of planting, probably from fear of rabbits. With such a vigorous growth of the underwood as we have here, it is hopeless to expect that natural oak and other seedlings will be able to continue alive for fourteen years in the dense underwood.

There are also now almost exclusively oak standards, except a few elms in No. 8 (Alderwood) and an occasional ash.

(2.) The underwood is excellent as regards density and species, and in woods twelve to sixteen years old the height growth is very satisfactory. During the last ten years, however, rabbits have increased enormously, and the younger coppice growth is being gradually thinned out and suppressed, all the yearling shoots being eaten down. If this be done for two years in succession the crop is ruined, and it is impossible to maintain the woods under such conditions. The only alternative to the wholesale extermination of the rabbits is to wire-net the woods, and to substitute conifers for broad-leaved species. But this would alter the entire aspect of the woods and spoil the coverts for pheasants, besides driving the rabbits on to the farmlands to the damage of the crops.

If it is desired to keep a certain number of rabbits on the estate, a separate piece of land should be fenced strongly and wired, and allowed to grow up with such thorns, gorse, etc., as the rabbits will allow to exist, and to treat it as a warren, trapped rabbits from the rest of the estate being put into it. I know of a property in Perthshire where this is done, the rest of the estate being practically free from rabbits. At the same time, if rabbits are kept down there will be more hares on the estate, and, as they have a much wider range and feeding grounds than rabbits, they do very much less damage.

PART III.—THE FOREST NURSERY.

There is an excellent nursery of 2 acres in Stisted village, near the Hall. It is nearly level, and the soil a deep sandy loam with at least 18 inches of good soil. There is a pump close to the nursery for watering the seed beds, to which a tank

should be added, so that the water may be warm when applied to the plants. The tank should be raised above the ground and a tap supplied, so that a water-barrow can be filled easily.

The nursery is divided into plots about 50 feet wide by three rows of apple trees and filberts, the latter requiring to be cut back. It is unusual to grow fruit trees in a forest nursery, but there appears to be plenty of room for them here. Their roots may, however, deprive forest plants of moisture in dry seasons, and on the whole it is better to remove them. As plants suffer from exposure to the morning sun, it is advisable to divide the nursery by lines of Lawson's Cypress running north and south, so as to keep off the eastern sun.

The present contents of the nursery are 1,000 spruce, 2,000 sweet chestnut, a few Scotch pines, silver-firs, etc. All these plants should be used next autumn to fill up gaps in the woods, or in the ornamental plantations. As there has been splendid natural regeneration of oaks in Lyons Hall Wood (No. 13) several thousand oak plants have been lined out in the nursery.

The area requires careful wire-netting, as rabbits and hares get in at present and may destroy all these young oaks.

It will be seen further on (Part IV.) that it is proposed to plant 50 sapling broad-leaved plants and 50 larch plants four years old per acre on the sites of the annual fellings. As the latter average about 11 acres, 550 broad-leaved and 550 larch plants will be required annually for these alone besides the plants required for planting the plots of 8 and 12 acres of new land. The latter will be planted once for all, so that if the work of planting there is to be done next autumn, the necessary plants for these areas should be purchased, and will have nothing to do with the nursery. All that is required from the nursery is the production of 550 broad-leaved and 550 larch per annum, or to allow for failures say 700 of each kind.

The best way to produce regular crops of oaks is to line out yearling oak plants 1 foot by 6 inches, and leave them alone for five years, by which time they will have straight stems and good root-systems. Ash plants similarly planted as yearlings will be ready in four years, and so will sycamore

236 Working-Plan of Stisted Hall Woodlands.

plants. A few seeds of black walnut also should be sown yearly in the nursery.

Until the nursery produces plants of sufficient age, it will be necessary to purchase the annual planting material. Sufficient larch seed should be sown at once to secure the necessary larch plants, yearlings being lined out 9 inches by 3 inches.

A few Spanish chestnuts and ash will be required annually for replacing dead coppice stools. It is impossible to say now what numbers of these will be required, but experience gained in a few years' time will determine the figure. After this year's cuttings the woodman should examine carefully the areas cut, and should plant any gaps that occur next autumn, after he has planted the broad-leaved saplings and the larch transplants. The plants for re-filling the underwood must be purchased, until a regular supply is available from the nursery, but steps should be taken to ensure a succession of five-year-old broad-leaved saplings and four-year-old larch transplants, of about 1,400 every year. Blank areas in the nursery should be well-manured and used for potatoes.

PART IV.—FUTURE MANAGEMENT.

It is proposed to continue the system of coppice-with-standards as the chief method of managing the Stisted woods.

It is also proposed to plant certain areas of larch and willows, but these will be outside the general scheme of management, and are dealt with in a subsequent chapter.

As the rotation is fourteen years old, and the area 149 $\frac{1}{4}$ acres, between 10 and 11 acres of underwood should be cut annually. As, however, about 12 acres of the underwood are 15 and 16 years old, and the cuttings during the past two years have been 12 and 15 acres respectively, it is not possible at present to arrange for felling equal areas annually, and the following arrangement is proposed :—

This winter the following areas have been cut :

No.	3.	Corner piece	...	...	...	1 acre.
"	5.	Greenfield spring	...	...	3 $\frac{1}{2}$	"
"	6.	Braintree wood	...	...	5	"
"	16.	Boathouse plantation	...	...	2	"
Total			...	...	11 $\frac{1}{2}$	acres.

Next season it is proposed to fell :

No. 1. Stable wood	...	...	...	4 acres.
" 2. Mott wood	...	...	...	4 "
" 18. World's end	...	...	...	1½ "
" 8. Alder wood	...	...	...	2 "
			Total ...	<u>11½ acres.</u>

We should then cut the following areas in succession :—

1909.	10½ acres.	Compartments No. 2, 8, 13.
1910.	9½ "	2, 14.
1911.	10 "	10.
1912.	10½ "	2, 14.
1913.	11 "	4, 13.
1914.	10½ "	2, 7, 14a.
1915.	10 "	7, 10, 11.
1916.	9½ "	2, 11, 19.
1917.	11½ "	10, 12, 17.
1918.	11 "	9, 14, 15.
1919.	11 "	10, 13.
1920.	12 "	1, 2, 9.
1921.	11½ "	3, 5, 6, 16.
1922.	11½ "	1, 2, 8, 18.

149½ acres.

This appears to be as regular a succession of age-classes as the present condition of the woods will allow.

If the 8 acres between Lower and Leafy Woods are also planted so as to increase the area of the coppice-with-standards woods, the first fellings there might be in 1909-10-11, so as to raise the areas felled there every fourteen years by 2 acres in each compartment.

After each felling has been made, in the ensuing autumn, about fifty oak and ash saplings per acre, say 5 feet high, should be planted, being evenly distributed among the coppice stools. At the same time fifty larch plants, four years old, should be planted similarly. As I have already stated, poplars, elms, or sycamore, and a few black walnut may be

substituted for some of the oak and ash plants. The method of rearing these plants in the nursery has been described already. These plants are intended to form the future standards. Whenever the coppice has been felled, such old standards as are mature should be felled, and those among the younger standards that are badly shaped, unhealthy, or otherwise defective. This removal of standards will give additional room for the planting of saplings.

In the year after the felling of the underwood in any compartment, all epicormic branches that may appear on the boles of the standards should be pruned away carefully. This is best done by means of a broad, sharp chisel, specially made for this purpose, and mounted on a pole. Sometimes two lengths of poles, 10 and 20 feet, are used for this operation. At the same time the young saplings that were planted the previous year should be inspected, and set free from weeds and invasive coppice shoots.

Nothing has hitherto been said about planting underwood. As the chief revenue in future is to come from standards, it will not be necessary to plant underwood, except where the existing stools are very thinly distributed. In such cases strong sweet chestnut or ash saplings should be planted, and they will be cut back at the next felling of the underwood.

Until the rabbits have been exterminated it is advisable to surround each sapling or larch plant with a narrow cylinder of wire-netting, firmly pegged into the ground. This should not cost more than 1*d.* for each plant so protected.

Directions about the work to be done in each block are given in the remarks column of next chapter. From this, and in accordance with the general directions in the working-plan, a scheme of each year's work, showing areas to be dealt with and number of plants required, should be prepared every June, and submitted to the owner of the estate for sanction. After his approval has been secured, this annual plan of operations should be strictly carried out.

It will be necessary to inspect the newly-planted saplings and larch in the fifth and tenth years after they have been planted, so as to protect them against the strong growth of the coppice shoots. Any shoots interfering with these plants should

be cut. The following table shows when this should be done, the operation being repeated every five years.

Year.	Area.	Nos. of Blocks.
	Acres.	
1909	11	9, 14, 15
1910	11	10, 13
1911	12	1, 2, 9
1912	11 $\frac{1}{2}$	3, 5, 6, 16
1913	11 $\frac{1}{2}$	1, 2, 8, 18
1914	10 $\frac{1}{2}$	2, 8, 13
1915	9 $\frac{1}{2}$	2, 14
1916	10	10
1917	10 $\frac{1}{2}$	2, 14
1918	11	4, 13
1919	10 $\frac{1}{2}$	2, 7, 14a
1920	10	7, 10, 11
1921	9 $\frac{1}{2}$	2, 11, 19
1922	11 $\frac{1}{2}$	10, 12, 17

PART V.—DESCRIPTION OF COMPARTMENTS.

No. 1.—Stable Wood. 8 acres. Situated east of Halstead Road. Flat. Deep clay soil. Age of underwood, one and fourteen years.

Crop.—Standards well-distributed with some young poles. The older part is being cut this year. The underwood is good.

Rabbits have seriously damaged younger underwood. Fill up gaps in both areas next autumn with saplings and larch.

No. 2.—Mott Wood. 38 acres. Situated west of Halstead Road, adjoining No. 1. Similar soil. Age of underwood, one, five, six, eight, ten, fourteen, and fifteen years.

Crop.—Part cut last year. The rest of the block is similar to No. 1, but the underwood is inferior.

Similar treatment to No. 1 on part that was cut.

No. 3.—Corner piece. 1 acre. Situated due north of No. 2, separated from it by a road. Similar soil, etc. Age of underwood, fifteen years.

240 Working-Plan of Stisted Hall Woodlands.

Crop.—Cut this year; contains one large oak 100 cubic feet that should be felled. Only a few other small standards. Fine chestnut and ash underwood.

Remarks.—Similar treatment to No. 1. Rabbits must be kept down, or the new underwood will not be equal to the former crop.

No. 4.—Broadfield Wood. 4 acres. Situated south of road by Sir G. Pechell's land. Age of underwood, eight years.

Crop.—Middle-aged underwood.

Remarks.—Will be allowed to grow to maturity.

No. 5.—Greenfield Spring Wood. $3\frac{1}{2}$ acres. Situated north of No. 4, and Sir G. Pechell's land. Clay soil in good condition. Age of underwood, fourteen years.

Crop.—Very fine underwood. Some old standards and a lot of fine young trees. Also a small area of fine larch poles 80 feet high and 2 to 3 feet in girth.

Remarks.—Has been cut this year. The larch poles may be further thinned and the site filled up with ash and sweet chestnut, and the necessary saplings and larch plants.

No. 6.—Braintree Wood. 5 acres. Situated at extreme north of estate, adjoining Mr. J. Hayward's property. Soil as in No. 5. Age of underwood, sixteen years.

Crop.—The standards are mostly large and not evenly distributed. The underwood is hazel and sweet chestnut, 25 feet high.

Remarks.—Has been cut this year. Fill in with saplings next autumn and protect against rabbits.

No. 7.—Clapgate Wood. 6 acres. Situated in Bocking parish, along road from Braintree to Halstead. Soil is a deep yellow loam. Age of underwood, five and six years.

Crop.—Standards mostly old, with some medium ones. Underwood mostly hazel, injured by rabbits, with some chestnut 20 feet high.

Remarks.—As saplings are wanted here, plenty should be planted when next the underwood is cut.

No. 8.—Alderwood. $3\frac{1}{2}$ acres. Situated north of Woolmer Green Farm. Clay soil, in good condition. Age of underwood, ten and twelve years.

Crop.—Two acres of this will be cut next year, and the rest

in 1909. Standards well distributed, with some fine elms. Underwood very fine alder, with some other species.

Remarks.—When cut should be duly filled up with saplings and larch. The value obtained for these elms should be noted specially, in order to see whether more elms should be planted. Their rate of growth should also be noted.

No. 9.—Leafy Wood. 12 acres. Situated on land recently bought of Clerton Hospital. Age of underwood, one and two years.

Crop.—Underwood rather thin. Some medium standards left, with poles and saplings.

Remarks.—Fill up this autumn with strong ash saplings.

No. 10.—Lower Wood. 26 acres. Separated from No. 9 by bad pasture which should be planted. Lately bought. Soil a wettish clay. Age of underwood three and ten years.

Crop.—Older standards were felled before sale. Those left now about 4 feet in girth and under, fairly dense in north of block. Hazel and ash underwood eaten by rabbits.

Remarks.—Ash and chestnut underwood should be planted next autumn wherever there are gaps. Saplings will not be planted till next felling of underwood.

No. 11.—Bramble Wood. 4 acres. Situated north of road from Bocking to Woolmer Green Farm. Underwood four and five years old.

Crop.—Standards badly distributed.

Remarks.—When next felled saplings and larch will be planted.

No. 12.—Middle Wood. 3 acres. Situated south of No. 11 along road. Age of underwood three years.

Crop.—The standards are large, but insufficient in number. Smaller age-classes insufficient.

Remarks.—When next felled saplings and larch will be planted.

No. 13.—Lyons Hall Wood. 18 acres. Situated south of road, below No. 12. Age of underwood, eleven, eight, and one years.

Crop.—The oak standards are up to 40 feet in bole and 4 to 6 feet in girth, the largest 9 feet in girth. On the area cut last year is a dense crop of seedling oaks.

Remarks.—The standard oaks should be trimmed of epicormic branches, and ash saplings planted in the area recently cut, next autumn.

No. 14.—Covens. 9 acres. Situated north of Hall, near the Glebe land. Sand and gravelly soil, with loam on lower ground. Age of underwood, two, nine, and ten years.

Crop.—The younger part of this (4 acres) was planted with elm, sycamore, and larch, but the plants have been badly injured by rabbits. One acre below was planted with chestnuts, which are also alive. Lower down ash, chestnut, and sycamore, with a few larch, were planted twelve years ago. They are now 16 to 20 feet high. The rest of the area is stocked with old standards over fine underwood.

Remarks.—This younger area should be fenced securely and wired at once, and in the autumn of 1907 replanted with sweet chestnut and larch, 4 feet apart. Fill all gaps in better crop with chestnut. When the older part is cut in 1911 the chestnuts on the younger part should also be cut back to form underwood. At the same time the poplars in the older part should be felled and sufficient oak and ash saplings and larch planted.

No. 14a—Piece near nursery. 1 acre. Situated near Rectory. Age of underwood, seven years.

Crop.—The small areas following require no special description.

Remarks.—Will be cut in 1914.

No. 15.—Jenkins Ashground. 1 acre. Situated on an out-lying plot near Mr. Tabor's land. Age of underwood, two years.

No. 16.—Boathouse Plantation. 2 acres. Situated south of the river, in the parish of Bocking. Age of underwood, fifteen years.

Crop.—Was cut this year.

Remarks.—Plant suitable saplings this autumn, 1907.

No. 17.—Plantation at top of lake. $2\frac{1}{2}$ acres. Situated south of the river, in the parish of Bocking. Age of underwood, three years.

No. 18.—World's End (two pieces). $1\frac{1}{2}$ acre. Situated outh of river, in parish of Bocking. Age of underwood, thirteen years.

Crop.—Will be cut in 1909.

Remarks.—Plant suitable saplings this autumn, 1907.

No. 19.—Ash Plantation at Bay Tree Farm. $\frac{3}{4}$ acre.
Situated in Braintree parish, at extreme south of estate. Age
of underwood, four years.

Total area—149 $\frac{3}{4}$ acres

PART VI.—FINANCIAL STATEMENT.

(a). *Revenue*.—No figures are available as to the past revenue of these woods, except as regards the underwood, which produces £3 10s. per acre, every fourteen years, after paying the cost of cutting and converting. That is 5s. per acre annually for the 150 acres of woodland, or £37 10s. per annum.

From experience gained on other similar estates, I should place the yield of the standards at 400 cubic feet per acre every fourteen years. I am certain from what I have seen of the rate of growth of oak here that this figure is not exaggerated. An oak sells at 1s. 10d. per cubic foot; the value of the annual fellings of standards should be about £36 per acre felled, every fourteen years, or say £2 10s. per acre annually. If we add to this the 5s. resulting from the sale of underwood, we shall have a revenue of £2 15s. per acre for the 150 acres of woodland, or £412 annually.

Until, however, the stock of young poles and saplings has been largely increased, so that there are, at each felling, trees growing up to replace these that are felled, it would not be right to cut so much as 400 cubic feet of timber per acre at a felling. The markings of the standards to be felled should, therefore, for the present be restricted to trees that are fully mature, or to such as are impeding the growth of trees better than themselves. The planting of larch among the underwood will soon increase the revenue, as this tree grows rapidly and is worth 1s. per cubic foot.

(b). *Expenditure*.—The cost of planting about 1,400 broad-leaved saplings and larch plants, including cost of the plants used, should not exceed £7, but until the rabbits are exterminated—as wire-net cylinders are to be used to protect the plants—this will be doubled and become £14 annually.

It stands to reason that only that part of the time of the woodman that he actually spends on forestry, should be charged against the woods. We may assume that this is half his time.

All fencing expenditure that is expressly intended to keep rabbits out of the woods should be charged to the Game account.

I should say that if we include all items properly chargeable to the woodlands account, that the annual expenditure on the latter will not exceed £60.

The cost of planting the new areas—8 acres between Lower and Leafy woods and 12 acres above the Boathouse plantation=20 acres at £6 per acre, including wire-netting—£120, is capital expenditure, only the interest on which should be charged annually to the woodland account, the capital being recovered when the trees become mature.

Conclusion.—In order that the owner may have a clear account of the financial condition of his woods, a book should be kept, in which a certain number of pages are reserved for each of the named blocks, including the new areas as soon as they are planted. On these pages entries should be made of every forest operation effected in the block, the number and kinds of plants planted, the cost of planting, volume and value of underwood cut. As regards the standards felled, full details should be given of their dimensions, volume, and value.

In this way alone the owner will realise what a valuable property are his woodlands, without which the expense of maintaining his fences and buildings would be vastly increased. The increased value they afford to his property by their amenity and sporting value are also obvious factors.

W. R. FISHER.

6, LINTON ROAD, OXFORD.

15th April, 1907.

SOME NOTES ON THE FORESTS OF
SWITZERLAND.

A.—STATISTICS.

THE forests of Switzerland extend over about 2,196,000 acres (878,489 hectares). Of these 66.9 per cent. are communal, or belong to corporate bodies, 4.3 per cent. belong to the Cantons, which correspond to "the State" in other countries, and 28.8 per cent. are private forests. The Confederation exercises a control over all the forests, but does not own any forest area.

Thus, 21.24 per cent. of the area of the country is wooded, 25.2 per cent. is formed by glaciers, lakes, water-courses, towns and villages, roads, railways and rocky ground, unfit for tree-growth, so that only 53.56 of Switzerland is under agriculture, or about 1½ acres per head of the population. It is, therefore, evident that the lands under agriculture cannot be reduced, and if the production of wood is to be increased in Switzerland, this can be done only by planting with trees the bare mountain slopes; this is impossible in many cases, either owing to the altitude, or to the proximity of torrents, the regular passages of avalanches, or to the nature of the soil. It is, therefore, only by striving to improve the management of existing woodlands that the Confederation and the Cantons are endeavouring to keep in the country the millions of francs that industry pays annually to the foreigner for the purchase of timber.

Between the years 1876 and 1903, the date of the promulgation of the Federal Forest Law, the Confederation supervised only the Alpine woodlands; its object was to prevent the destruction of protective forests. Now, by applying article 24 of the Act of Constitution of the country, that became law on the 15th October, 1897, and by virtue of the new Forest Law of the 13th March, 1903, the Federal Council supervises the policy of all the forests in Switzerland, forests and wooded pastures, public or private.

B.—FEDERAL FOREST LEGISLATION OF 1903.

The principal measures which the Federal Chambers have adopted in order to protect the forests, and also to increase and regulate their productivity, are as follows:—

We will not describe, in this short paper, the Cantonal laws, which specially govern the forests of each of the twenty-five Cantons of the Swiss Confederation. They merely have brought their laws and administrative regulations into harmony with the Federal Forest Law. There is, therefore, no conflict, nor any contradiction, in all these laws, but often the Cantons have deemed it necessary to add fresh restrictions to the rights of forest-owners.

I. *General Provisions of the Law.*—Forests are classified into two great groups—*protective forests* and *non-protective forests*. According to article 3, protective forests are those that exist in the basins of torrents, and which, by their situation, protect the country against harmful climatic influences, avalanches, sliding down of stones and ice, denudation, or against too great changes in the direction of water-courses.

II. *Provisions of the Law as regards Public Forests.**—All public forests that are not already under working-plans, and administered in accordance with Cantonal instructions, in future will be so administered.

The working-plans for protective forests are to be drawn up, so that article 3 of the law shall be followed as far as is possible under the circumstances, and the annual yield of the fellings shall never exceed the volume of wood produced annually by the forest.

As a general rule, clear-cuttings are forbidden in protective forests. Rights-of-common, and other rights to minor produce (litter, pasture, passage of cattle, etc.), which burden the forests, and prevent their proper management, are purchased, and the land itself purchased, if this be necessary.

III. *Provisions of the Law relating to Private Forests.*—There is a point here, that is a novelty in forest policy, and which should attract the attention of the legislators of other countries—that

* Belonging to Cantons, communes, corporations, etc.

is, the union of certain private forests, in order to frame comprehensive working-plans, and to work them co-operatively. The Confederation encourages these associations by defraying the expenses caused by these union of forests, and the Cantons supply managers gratis for such united private forests.

In protective forests the Federal Council and the Cantons not only encourage the formation of these associated private forests, but can compel the forest owners to associate in this way. As in the public forests, so also in protective private forests, *clear-cuttings are forbidden*. Most of the Cantons have ordered that all proposed fellings in forests are to be submitted to the District Inspector of Forests for his sanction, and that the trees to be felled shall be marked by his representative.

IV. *Protection and Extension of the Forest Area.*—The area of the Swiss forests is not to be reduced (art. 31 of the law), all clearance of woodland is forbidden ; only in exceptional cases may the Federal Council or the Cantonal Governments decide to what extent a clearance can be replaced by new plantations or waste land.

The Cantons see that all fellings, as well as all blanks in a forest caused by fire, storm, avalanche, etc., are replanted closely, in a period that shall not exceed three years.

Measures are taken in order to maintain the present area of wooded pastures. Also land that may be converted into protective forest is planted by order of the Confederation or of the Cantons. This law has, evidently, in view the protection and economic aspect of forests ; it does not hesitate to limit, and to limit severely, the time-honoured rights of private property, in order to rescue mountains and forests from their bad treatment by certain landowners.

In the public forests the intervention of the State is still more decided, as such forests are managed by State forest officers, who prepare working-plans, and see that they are carried out. Heavy compensation must be paid to the owners of forests in return for the restrictions to their ancient rights, and this has been done very liberally by the State.

V. *Compensation to be Paid.*—The Confederation contributes as follows :

Salaries and vacations of the Cantonal forest officials (20 to 30 per cent. of the cost).

Cost of Forest Education.—Formation of new protective forests and engineering works involved (50 to 80 per cent.); also to the owners of the land thus occupied, three to five times the value of the annual yield, calculated on an average for the last ten years.

For 30 to 50 per cent. of the cost of plantations made in protective forests, when due to extraordinary causes, such as forest fires, ravages by insects, avalanches, storms, etc.

Finally, up to 20 per cent. of the cost of export roads and other permanent means of transport for forest produce. This judicious measure certainly will contribute much to improve the management of many forests.

C.—SOME DETAILS LIKELY TO INTEREST FOREIGN SILVICULTURISTS.

If a regular Swiss forest service dates only from 1876, it is nevertheless true that, long before that date, many Cantons and towns, knowing the importance of administering their woodlands properly, engaged competent forest officers to manage them. Other administrators of forests commenced serious forest work after 1876, and are now proud of the results attained, but, unfortunately, many communes have shown great apathy in this matter, that it has been very difficult to combat. In concluding this short paper, I will cite some districts that are of special interest to visitors.

1. *In the Jura.*—The splendid high forests (beech, silver-fir, spruce; and spruce, silver-fir) of the town of Brienne and of the district (*arrondissement*) of Couvet (Canton of Neuchatel). The former are treated in the lower and middle slopes of the hills by the classic method of successive shelter-wood fellings, under the compartment system. They are situated on fairly fertile land and grow rapidly, and afford good natural regeneration of the above-mentioned species, to the satisfaction of the local forest officer.

The neighbouring forests of Couvet are under the selection

system, by the method of Control*, which gives splendid results. Thus, in many working-sections, on fairly steep slopes, with average fertility of soil, annual increments of 15 cubic meters per hectare (210 solid cubic feet per acre) are obtained. The truth of this statement has been verified repeatedly.

2. *On the Plateau*.—The admirable beech forests and beech and siver-fir forests of the Sihlwald, belonging to the town of Zurich, deserve special praise. Here the means of transport and the conversion of timber are carried on with great detail. Thus, in the centre of the forest there is a factory, where every tree is converted so as to furnish the most useful material.

3. *In the Alps*.—Forest management here is on the most extensive scale. Most of the forests are in remote situations, at the bottom of steep valleys, or at very high altitudes (forests of larch, Cembran pine and spruce, up to 7,640 feet, and even higher). Yet:—owing to the railways that have been constructed almost everywhere; to wire-tramways, which many administrations have constructed; to the pecuniary assistance of the Confederation for transport of forest produce:—this part of the Swiss forests, which is so interesting and picturesque, serves most of all to increase the timber supply of the country, while the mountains are becoming covered by a steadily increasing area of dense forests. In the Canton of Tessin are the most numerous wire-tramways. One of the most interesting of these is in the canton of Vaud, between the forest de la Joux-Verte (altitude 3,900 feet), and the village of Roche, near Aigle, in the plain of the Rhone (altitude 1,300 feet).

The system applied in the alpine forests, which are composed low down of spruce, silver-fir, and sometimes of beech, and higher up of spruce, larch, and Cembran pine, is that by which the forest will remain always protective, and which protects the soil against hurtful climatic influence. It is therefore usually the selection system, individual trees only being felled here and there, while in the most fertile and least exposed localities, successive fellings under a shelter-wood, with a decided leaning towards selection, are carried out.

In order to complete these notes, the numerous plantations

* This is a special method which was shown to members of the R.S.A.S. at Champenoux, near Nancy.

made between the water-partings of torrents (*Périmètres des torrents*), and the engineering and other works constructed to prevent the formation of avalanches, should be described, but this would go beyond the purpose of this sketch. The best works for fixing torrents are in Oberland Bernois, Oberland Grisons, Valley of the Tessin, Alpes Vaudoises and Fribourgeoises, etc.

Works against avalanches may be seen at Pontrasina (Engadine), High Valley of the Albula, in order to protect the Rhétian railway.

OXFORD, JUNE 7th, 1908.

JULIEN MOREL.

FENCING.

Competition VII.—Awarded a Silver Medal.

“**I**T is not necessary to deal with the fencing of ground against cattle or sheep, as this branch of work has no particular application to forestry, but fencing against ground game is an almost invariable preliminary to planting or replanting ground of any kind.”—A. C. F.

Considering the first part of the above quotation, I quite agree with the writer that fencing has no particular application to forestry, yet, can it be said that such work does not concern the forester? I venture to say that it does, and that, sometimes, to a considerable extent.

It is only on some of our largest British estates that a separate fencing squad is maintained. In that case fencing has nothing to do with either forestry or the forester, but on most estates the forester has generally both woods and fences in charge, be the fences either for wood protection or purely for stock.

On estates where the preservation of game has the preference before general forestry work, fencing very often constitutes a great part of the forester's summer duties, and so it behoves most foresters to make themselves acquainted with fencing as well as with silviculture.

The fencing of woods against ground game is most important to a forester. So much damage can be done in a very short time by stock getting into a young plantation, through the fences being in bad repair, or through the fencing material

used being too light and thus easily broken, or to the fence being improperly fixed, that a forester dreads such an occurrence, and does his utmost to guard against it. When we consider that pest of all foresters, the rabbit, it is still more necessary to fix rabbit-proof fencing properly.

Considering fencing as a whole, the styles and methods of fixing are so varied that for anyone to say this style or that method is the right one, would be absurd, and would soon find plenty of contradiction, but it can be said emphatically that far too many of our estate employees have got into a groove in their fencing.

I have noticed, and also been informed by others, that on many estates one class of fencing is predominant, and if that class of fencing were really good and suitable to all places, then, with the exception of one thing, it would answer all requirements, the exception being that it looks better to vary the style of work sometimes.

I am sorry to say, though, that on such estates the one class is just as often erected in unsuitable as in suitable places, and when we consider the various positions that fences have to be erected in, and the requirements in each case, it is obvious that one class of fence is not suitable everywhere. There are so many varieties of fencing to choose from, many not differing much in cost one from another, one style being just as suitable as another in some cases, that no one need confine himself to any one class, but have his work more varied, more pleasing to the eye, as well as having suitable fences for different positions.

Taking it for granted, then, that fencing round woods has something to do with forestry, inasmuch as the fences are nearly always against stock, one might add that a forester ought to know something as regards stock-fencing between fields, and so the two, forestry and fencing, can be connected.

The question then is, "How are we to improve ourselves in this line?" Are we to go on in the same old rut as is so commonly done? Most certainly not. Or are we to strike out on new lines; to strive to be something more than a mere cipher in our work; not doing work in a certain way because someone has done it in that way before us; to strive to be original? To this I say, Yes.

It is known that classes of fencing vary in different localities, owing perhaps to the climate, the abundance of any one class of fencing material to be had in one district, or the scarcity of such material in another. Thus we have on some estates nearly all thorn hedges, because the climate or soils suits the growing of thorns. In others, wire or rail fences are predominant, the climate, etc., not being suitable for hedges. Again, estates where the ground is rocky and stone easily procured one finds all dry-built stone walls. In the extreme cases there is not much scope for different styles of work; one has to make the best of things with the material to hand. But there are plenty of estates that can be classed as medium, because thorns will grow, and because of the abundance of fencing or building material to be had. Wire or rail fences can with a few exceptions be erected nearly anywhere, leaving us only to consider which is the most suitable fence for the position.

The question of cost must be considered, and for that it would be necessary to have the prices of material from different districts to enable one to give an approximate cost suitable to all; but so much depends upon local circumstances that it is well nigh impossible to give a definite cost for a fence, and so I can only give a local one.

On some estates the smaller class of timber is used for cutting up for fencing material; on others, the larger, while the state of the iron market sometimes makes a great difference in the price of wire, wire-netting, etc., in a single year, a fence that would cost, say, 1s. per yard now, might in a few months cost 1s. 2d.

Regarding the size of timber used for cutting up in the estate sawmill, this is again an open question, some men prefer small, others large timber; on some estates, where perhaps the income is none too large for the calls made upon it, it is preferred to sell the large timber and keep the smaller for home use. Personally I prefer to cut up the large timber for fencing material. I think more durability can be got from the wood, certainly more heartwood and less sap, whilst the timber does not waste in cutting up. This again varies with the requirements in each case. Some foresters prefer quartered timber,



W. R. Price.]

[*Photo.*

Plate I.—Russian Larch at Raivola.



making triangular posts, whilst others prefer thoroughly squared ones.

Most foresters know that rails cut from a small class of timber are often very knotty and frequent breakages occur, whilst those cut from larger trees are superior in quality, being clearer of knots.

Taking dry walling into consideration. In this class of fencing it would be folly to give a price per rod as a hard and fast rule of cost. There are places where walls can be built at about one half the expense incurred in other neighbourhoods. Certainly the greater difference lies in the quarrying and carting of the stones; the price of erecting will not perhaps vary materially.

When we consider fences in which manufactured iron is used, prices can be given only for each fence. The local circumstances and the state of the iron market must be considered in each case.

Tools Used in Fencing.—These are many. Of the spades, picks, saws, hammers, and small tools, it is needless to say anything, but a word about the mallets used. Some men prefer wooden ones, others wrought iron, and others cast iron. The wooden ones are probably the oldest pattern, and a certain number of men still put their faith to them, but I think they are gradually dying out as an estate fencing tool. One thing which has been said in their favour is, that owing to the larger driving surface less post splitting occurs than when the iron mallets are used. They are generally not very heavy, and iron mallets are taking their place, owing to the fact that more weight can be got for driving power with less bulk. The wrought iron mallets are good useful tools, averaging from 12 to 16 lbs. in weight, and can be used for lots of other work besides post driving; but I think their greatest fault lies in the fact that they can seldom be made with a larger than a 3-inch face; because when making them in proportion, with the compressed state of the iron, to make them larger than that would result in too much weight. The cast iron ones, I think, are those which find most favour; true, they can be used only where wood is concerned, but a good proportionate mallet can be got with a 4-inch face, and a weight of 14 lbs.

Anyone after having got thoroughly used to the cast iron mallet will drive posts, except in exceptional circumstances, with few breakages.

There is another tool which I think deserves notice. I refer to a screw machine for preventing the posts splitting whilst being driven. To describe it. A square of iron 6 inches long by $3\frac{1}{2}$ inches wide, made of 2 inches by $\frac{3}{8}$ inch material; a bolt nut is welded in the centre of one end, through this and the end of the square a threaded bolt is passed, having on the outside end a loop through which there is a movable handle for working the screw; on the inside the screw is riveted through a counter sunk hole to a movable plate which has flanged ends, and which is moved along the square by the screw. The machine is placed on the post to be driven about an inch from the top, and screwed tight, the workmen taking care that if it works up during the driving to lower it out of the way of the mallets. In no case must this article be used as a post holder, or the screw would soon be spoiled. The cost of making it is light, and as the posts used on an estate generally run in about two or three sizes it does not entail an heavy expense to have one to fit all the sizes required; in fact when a fence has to be erected on hard and stoney ground the whole cost can be saved easily on one fence by having less breakages.

I shall now endeavour to describe a few of the fences that are in use in different districts on some estates which I know, and with which fences I have in most cases had some connection. I shall give the cost in some instances, but it must be understood that as the erection of these fences has been spread over a considerable number of years, the cost given must not be taken as the rule, but be considered on the lines I have before mentioned regarding cost.

To take the fences that can be erected with all home-grown material, namely, railing, etc.

No. 1.—Four-bar Rail Fence.—Height 3 feet 8 inches; posts 6 feet apart (centres). Material: all larch; posts 6 feet by $3\frac{1}{2}$ inches by 3 inches; rails 12 feet or 18 feet by $3\frac{1}{2}$ inches by $1\frac{1}{2}$ inches.

The rails can be spliced off or jointed on the posts. If spliced off the splice ought not to be less than 8 inches long

and should always have two nails. In jointing on the post the joint may be either perpendicular or diagonal; also it is very common to place the posts with the broad side for the joints. This ought never to be done, as a post placed broad way to is never so strong as when the narrow side is used. In this class of fencing the joint posts ought either to be larger than the others or a size of post used that would give a reasonable hold for a joint. Cost, 1s. 2d. per yard, fixed.

No. 2.—*Holed Post Rail-bar Fencing (four Bars)*.—Height to top of top rail, 3 feet 9 inches; posts 6 feet apart (centres). Material: joint posts 6 feet 3 inches by 4 inches by 3 inches—holes in same, 4 $\frac{1}{2}$ inches by 1 $\frac{1}{2}$ inches; centre posts, 6 feet 3 inches by 3 $\frac{1}{2}$ inches by 3 inches; rails, 12 feet 9 inches by 3 $\frac{1}{2}$ inches by 1 $\frac{1}{2}$ inches.

In this fence the joint posts are always fixed first so as to get the right length for the rails, which are *sliped* (Note i.) and jointed in the hole. It looks neater not to give the rail above 6 inches of *slipe* and not taking off above two-thirds of the width. The *sliped* end, if carried to a point, projects too far through the post, and as larch warps very much with the sun, the sharp point might be dangerous to stock. After fixing the joint posts and rails the centre posts are driven in the centre of each length. When it is desired to fix a wire on the post tops the centre posts ought to be level with the tops of the joint posts, which are 6 inches above the top rail; but when no wire is required it looks neater to drive the posts to within 2 inches of the rail. Cost per yard, fixed, about 1s. 4d. In this fencing the screw machine will be found a great preventative against breakages.

No. 3.—*Upright Paling Fence*.—Height, 4 feet; posts 5 feet apart. Material: larch posts and rails; spruce uprights; posts 6 feet by 3 $\frac{1}{2}$ inches by 3 $\frac{1}{2}$ inches; three horizontal bars 10 feet by 3 $\frac{1}{2}$ inches by 1 $\frac{1}{2}$ inches; pales 4 feet by 3 inches by $\frac{1}{2}$ inch by 2 $\frac{1}{2}$ inches apart and 6 inches above top rail. Cost, 2s. 3d. per yard, fixed.

In erecting all upright, paled or wood fences great care ought to be taken to get the posts well into the ground and properly fixed, on account of the wind pressure. From experience I find it is better to use a fair-sized post, and by so doing much firmer work is the result. The uprights can be

placed at any distance apart that may be fancied or required, but the closer the uprights are, the less space for air passage is left.

Another class of this fence which can be worked for more ornamental work is gained by using a long and a short upright. Sometimes the uprights vary only a few inches; but where a purely ornamental fence is required, use long uprights, say 3 feet 8 inches long, and short ones 2 feet 4 inches; uprights to be $2\frac{1}{2}$ inches by $\frac{3}{4}$ inch, if larch by 1 inch apart. The three bars would still be required, but it would be better to reduce the width to 3 inches in this height of fence. I have had a fence of this description erected lately, which, by using all larch, cost 1s. 7d. per yard.

One point of importance is that the short uprights should always exceed half the length of the long ones, while the centre rail ought to be placed with its top at the exact centre between the two other rails and so allow the greater space at the top.

No. 4.—*Castellated Upright Boarding Fence*.—Height, 5 feet; posts 5 feet apart; three horizontal bars. Material: larch posts and bars; posts 8 feet by 5 inches by 5 inches, sunk 3 feet 6 inches into ground; rail bars, 10 feet by $3\frac{1}{2}$ inches by $1\frac{1}{2}$ inches; battens, Scots fir or spruce, 5 feet and 4 feet 8 inches alternate by 6 inches by 1 inch by 1 inch apart. Cost per yard, fixed, about 3s. 3d.

This fence is a great wind resister, and so it is better not to stint in sinking the posts a good distance into the ground. It is also erected as a view breaker, and I have known it to be erected to prevent the wind from having a full blow at a young plantation on a very bleak hill. In that case it had to be stayed.

No. 5.—*Sleeper Fence*.—There need not be much said about this, as it is not a very common one for estate use. It is more frequently erected in colliery districts than anywhere else. The sleepers are sunk 2 feet 6 inches into the ground, placed 1 inch apart and bound at the top by a good strong rail. The cost might be estimated at 5s. per yard, fixed.

Gates and Gate Making.—Although this appertains more to the carpenter's than the forester's work, yet on some estates the woodmen make gates for use in wood fences; in fact I find

this a good employment for men on wet days. It is usually what are termed as "rough gates" that are made in this way, *i.e.*, the wood is not planed and the rails are let into the head and hartree with round edges. Such gates cost about 9s. per 10-feet gate, whilst a planed gate the same length costs 12s.

The style of gate usually found in this neighbourhood is one with six bars, flat bar on top of top bar and diamond sword bracing. The sizes of wood are—hartree, 5 feet by 6 inches by 3 inches; head, 5 feet by 3 inches by 2½ inches; rails, 10 feet by 3½ inches by 1½ inches, tapered to 3 inches by 1 inch; top roll, 9 feet 6 inches by 3 inches by 1½ inches; swords, 7 feet by 3 inches by ½ inch. For use in walls this height of gate is suitable, but where it is in use in a wire or rail fence the height is reduced slightly. The gate is made with three bars in the bottom half, one exactly in the centre and two above. The swords are fixed two on each side, using 2½-inch by ½-inch and 3½-inch by ½-inch bolts for fixing.

It has always been a knotty problem how to reduce the weight of gates and still retain the strength required, and to this end the light top bar gate is in use. In the gates which are made in this locality a top roll is used to strengthen the light top bar. The roll, with two edges planed off, is placed horizontally on the top of the rail, morticed into the hartree and head 1 inch, and screwed well down in the centre. This I find reduces the weight of the heavy top bar by one third.

Hangings.—Some men are of opinion that nothing but a long band should be used for a top hanging; but if a long top band be always used the light top bar must be made up to enable it to be fixed, and in that case it would be preferable to use the heavy bar and so save joints. The plea is that the long band prevents the gate from coming down at the head by working in the mortices; but as regards the diamond bracing, I can say that I know of gates that have been made in this style which have been in use for over thirty years, which have not given one particle and which have been hung with a short top band.

The screw bolt is often a favourite for a top hanging, the reason being that the gate can be lifted with it when down at

the head ; but to my mind its worst fault is that in fixing it reduces the thickness of the hartree by one third.

Considering the problem of weight, a short band for a light top-bar gate and a long band for strong top bars are the most suitable.

In hanging gates it is much better to have them at least $1\frac{1}{2}$ inches up than dead level ; sometimes, with every care in fixing, gates come down, but if particular attention is paid to the setting of the hanging-post, there is generally not much trouble entailed in this respect.

FENCES IN WHICH WIRE, ETC., IS USED.

No. 6.—*Wire Fence (seven Wires)*.—Height, 3 feet 10 inches ; posts 6 feet apart. Material : larch posts, 6 feet by $3\frac{1}{2}$ inches by 3 inches ; top wire, No. 3 galvanised 7-ply strand wire ; 2nd, 3rd, and 4th wires, No. 4 galvanised 7-ply strand wire ; 5th, 6th, and 7th wires, No. 6 galvanised 7-ply strand wire. Cost, with all necessary corner pillars and winders, 1s. 4d. per yard, fixed. The wires are as follows : 2, 9, 8, 7, 6, $5\frac{1}{2}$, and 5 inches, with about 4 inches space to ground. This class makes a good strong stock fence ; but there is a variation of it which deserves describing, and which makes a much stronger fence.

No. 6A.—*The Triangular Top-bar Wire Fence*.—Height, 3 feet 10 inches ; posts 6 feet apart. Material : larch centre posts, 6 feet by 4 inches by 3 inches ; joint posts, 6 feet by 4 inches by 4 inches. The triangular top-bar is obtained by sawing a rail 3 inches square diagonally, and either 12-foot, 18-foot, or 24-foot rails can be used. I find a rail 18 feet 6 inches long is about the handiest length to use, allowing the 6 inches for jointing or for taking up of the rail going over hills. The bar is nailed to the tops of the posts, which are levelled to fit by using $3\frac{1}{2}$ -inch steel railing nails, two to each post, driven in to cross, and one for joints. The joints are further strengthened and protected by having over them a band of hoop iron 20 inches by $1\frac{1}{2}$ inches fixed by two $1\frac{1}{2}$ -inch Nettlefold's band nails to each side, none being driven into the top, as it splits the rail. The rail can be either larch or pitch pine, the cost of either being very similar.

Only six wires are used, the first being 10 inches from the top, and afterwards 8 inches, and so on. This fence, by having the top bar edgeway to stock, is very strong—much stronger than a similar fence with a top rail nailed to the front of the posts. In hunting counties it can be worked to some effect, as the top bar clearly defines the height of the fence. The cost per yard would be from 1s. 5d. to 1s. 6d.

No. 7.—Wire Fence, using quartered Larch Posts.—Fence, 3 feet 6 inches high; posts 6 feet apart; six wires. Material: straining and corner posts, 7 feet 3 inches long by about 8 inches diameter; posts, piece of larch 5 feet 3 inches by 7 inches to 8 inches diameter, quartered and sharpened; three wires No. 5 and three ditto No. 6 galvanised solid wire, strained either by straining brackets for wood posts or ratchets. Cost per yard fixed, 1s.

This class of fence is more common in Scotland than in England. To describe the Scotch method of fixing:—The strong posts are fixed first, stayed with round larch, and then the second wires from top and bottom are run in and tightened. These form a guide for the driving of the posts, and when these are driven the remaining wires are fixed, the top wire is levelled through, and the post tops cut with a slope. The fence looks very well when finished: but I think its weakest point is in the posts; they, being quartered, often only allow for a short, dumpy point, and the top, being partly composed of sapwood and often larger than the face of the mallet used, suffers very much in driving.

No. 8.—Wire Netting Rabbit-proof Fence.—Any wire or rail fence can be used for fixing wire netting to, taking the precaution of fixing the netting on the side furthest from stock, but to consider a purely wire netting fence. Material: corner and straining posts, round larch, 7 feet by about 7 inches diameter; ordinary posts placed 7 feet apart by 5 feet by $3\frac{1}{2}$ inches by $2\frac{3}{4}$ inches by 3 feet 2 inches out of ground; No. 8 galvanised solid wires for top and bottom wires; wire netting, 42 inches by 1 inch by 18 g. (Note ii.); galvanised butterfly ratchets for straining, and No. 18 g. galvanised lacing wire, to lace netting to top wire.

Fixing.—Posts to have not less than 4 inches lean; wire

netting laced to top wire, 3 feet on posts and 6 inches flat on ground, well pegged down; bottom wire fixed above netting and stapled down close to ground, with three ties to netting in post length. Cost per yard (up to date), 10d. I have fixed a similar fence to this, but with a projecting wire netting 12 inches by 1½ inches by 18 g. at the top, fixed by bent irons 2 feet 4 inches by ¼ inch by $\frac{1}{16}$ inch, which were nailed to every third post, with a top wire of No. 8 galvanised solid wire to lace top of netting to, strong irons, 1 inch round, being used at corners. This makes a very effective rabbit-proof fence, but brings the cost up to about 1s. 2d. per yard.

FENCES IN WHICH WHOLLY MANUFACTURED IRON IS USED.

No. 9.—*Corrimony Fencing (six Wires)*.—Height, 3 feet 4 inches; wires from top, 2, 9, 7, 6, 6, and 5 inches, with 5 inches space to ground; straining and corner pillars 7 feet long by 1½ inches square, with star base and stay; intermediate standards, to drive bulb T iron, 5 feet 9 inches by 1½ inches by 1½ inches by $\frac{1}{2}$ inch, earth plate and stay to each standard; standards 18 feet apart, with three galvanised V droppers fixed between; wires, three No. 5 and three No. 6 galvanised solid wire.

I had a fence of this description, about a thousand yards long, fixed two years ago on a Fell eight miles from home, and the total cost of material and fixing, including carting, was 1s. 4d. per yard.

I am aware that the sizes of wire which I have used are stronger than usual; but where cattle as well as sheep have to be considered it is well not to use too light wires.

This fencing varies very much, according to the state of the ground whereon it is fixed. For instance, I fixed a similar fence on the same Fell last season, where, owing in some places to the soft peaty nature of the soil, the intermediate standards had to be driven 4 feet before they were down to the solid subsoil, whilst it also meant in many places having sole plates to the standards. This fence cost 1s. 8d. per yard.

From experience I find it pays, as in the foregoing case, to go to the extra expense of longer standards, getting them down

to the solid, than to erect a fence with an ordinary length of standard and have the fence sink considerably in parts afterwards. Galvanised strand wire is not suitable for this fencing, especially for Fell work, because of the fogs—it holds the moisture too long, and so rusts; whilst for ordinary work the contact with the iron also causes rust.

No. 10.—Wrought Iron Upright Fencing.—Example: Fence to stand 4 feet 3 inches above ground; standards, $1\frac{1}{4}$ inches by $\frac{3}{8}$ inch, fixed into stone blocks 14 inches by 14 inches by 12 inches; horizontal bars, $1\frac{1}{4}$ inches by $\frac{3}{8}$ inch, two to a length; verticals $\frac{5}{8}$ inch round, with half-hoop tops by $4\frac{1}{2}$ inches apart (centres); stays $\frac{1}{2}$ inch, round, fixed to stone. Cost per yard, material, about 5s. 9d. This fencing can also be obtained in 6-feet hurdle lengths, with pronged feet to standards at a slightly increased cost.

In all iron fencing where the standards are fixed into stone very great care ought to be taken in fixing. One sees so many iron fences of this class all out of straight, a short time after fixing, that it has the effect of deterring estate owners from making so much use of this fence as they would otherwise do.

To remedy this. The most important point is the setting of the standards. In the first place stakes ought to be driven at intervals along the line of fence, showing the height of the finished work. The workmen, in digging the holes for the standard stones, can by using a lath obtain the height of the standard and stone, and by the aid of the stakes ascertain when the hole is deep enough. Care ought to be taken to have as little loose soil as possible under the stone, which ought to be set rather high then by the use of two wooden beaters (hooped), one on each side, beaten down until the standard is the right height. By this means the stones are got solid, and it is better to take the time in the first instance than to have to go over the fence later to straighten it.

The above example was fixed about ten years ago with the standards set in this way, and to my knowledge no one has been over it since, nor does it require straightening up in the least.

No. 11.—Horizontal Bar Fencing.—Height, 4 feet; joint standards prepared for stone, 2 inches by $\frac{1}{2}$ inch intermediates

with pronged feet, $1\frac{1}{2}$ inches by $\frac{3}{8}$ inch ; top bar, $\frac{7}{8}$ inch square, fixed on angle ; five lower bars, $1\frac{1}{2}$ inches by $\frac{3}{8}$ inch. Cost of material, 2s. 11d. per yard. This forms a very good fence for park or pleasure ground use. Care ought to be taken in the setting of the standards, as in example No. 10, and if used to fence against stock ought to have a $\frac{3}{4}$ -inch square stay fixed to each joint, taking care, if possible, to fix the stay on the opposite side from the stock.

I have not gone into the question of walling ; the prices vary so much. In this neighbourhood walling can be done from 7s. to 8s. per rood for building alone. In dry wall building the main points are—get a good foundation, *through* well (Note iii.), give the sides plenty of slope and fill the centre well. An average wall is 4 feet 6 inches high, 24 inches wide at base, and 14 inches under top stones.

Regarding such work as rustic fencing, no cost can be given for that, and it is needless to describe the styles. It cannot be said to be a proper fence, where stock is concerned, but is generally erected for effect in grounds.

There is another work which sometimes occurs in fencing ; I refer to water-gates. The methods of fixing these are many, some favouring a chain or wire rope to hang the gates to, others a wooden pole. I prefer the pole myself. In erecting one two years ago with a pole 42 feet 6 inches long by 9 inches square I used 12-inch square posts. The pole was bolted on 3 feet from the top and had an iron stay fixed to the post 2 feet 6 inches above it, to within 6 feet of the centre, the pole in the first place being lifted up in the centre by a screw jack. The posts I found it best to sole and set with concrete. Where it is desired to fence ground at a stream side that is liable to be flooded, a series of hanging light poles can be used—posts 8 inches square to be set into the ground and 10 feet apart, the poles to be chained to a post at one end and the other end resting in an iron arm. When the flood comes they are lifted by the water until above the arm and then washed clear.

All the foregoing classes of fencing are subject to variations ; I have only given types. In the rail fences as many rails can be used as would be suitable for the work required ; in the wire fences the same applies. In No. 6A a rail instead of

the top wire makes a good change. The wire-netting cannot vary much, nor yet the corrimony fencing, but in the iron fencing the styles are many. I have not mentioned any of the foreign fencing, thinking it better to apply myself to British work, but when there are so many different types to work upon, there is no necessity to get into a groove in fencing.

NOTE i.—*Slip*, taking off a corner, a technical term used by fencers.

NOTE ii.—*G.* means *gauge*.

NOTE iii.—*Through*. Name of a stone, going right through a wall, used here as a verb.

J. C. ARCHIBALD, FORESTER.

EDEN HALL, LANGWATHBY, R.S.O., CUMBERLAND.

THE SCHOOL OF FORESTRY.

ROYAL FOREST OF DEAN.

THIS school was opened in January, 1904, by the Commissioners of Woods and Forests, and, with the exception of Avondale, in Ireland, is the only one of its kind in the United Kingdom. It is for working-men only, and to obtain admission students must be willing to work as Crown labourers in Dean Forest while they are at the school. The course extends over two years, during which time the students attend lectures in the school on two afternoons every week from 1.30 to 4 p.m. They are there taught silviculture, forest protection, the measurement of felled timber and of standing trees and woods, forest management, elementary botany, accounts and surveying. During the remainder of the week they are working as labourers in the woods, and learn thoroughly the practical work of planting, nursery work, weeding, thinning, felling with saw and axe, the measurement of timber, barking oak, hedge-laying, etc. In addition each student works for from two to three months in the carpenter's shop, making gates, etc. The students are also taken for many walks and excursions in the Dean Forest, Highmeadow, and other surrounding woods.

The hours of work are from 7 a.m. to 5 p.m. in summer, and from 7.30 a.m. to 4.30 p.m. in winter with half an hour off

for breakfast and dinner. Every alternate Saturday is a half holiday.

On leaving the school the men are not only familiar with the general theory of scientific forestry, but they are practical men and can do all ordinary forest work with their own hands. The older men are capable of taking charge of the woods on private estates, while the younger men make capable assistant foresters, or working woodmen.

A new class of students is admitted every year, and up to date thirty-nine men have entered the school. Of these four were dismissed as unsuitable before completing their course, four have been appointed Crown woodmen, one is inspector of telegraph poles in the postal department, five obtained situations on private estates as forester or woodman, one is in a large public nursery, eight are employed as labourers in Dean Forest, and sixteen are still in the school.

Until now the age of admission has been from sixteen to twenty-three, and the students were paid 10s. per week, the education being free. This age was, however, rather too low, as, on leaving the school, the greater number of the men are still too young to take charge of woods. It has, therefore, been decided to raise the age, and the students to be admitted in November next must be between twenty and twenty-five, and they will be paid 15s. per week. As board and lodging can be obtained for 11s. to 12s., this will enable a student to live without any further allowance from home.

The school is at present held in a temporary structure at Parkend, which is in a fairly central position in the forest, but a permanent building is now being constructed and will be ready for occupation next March or April.

The Forest of Dean and other surrounding Crown woods have a total area of about 24,000 acres, situated at elevations varying from 50 to 1,000 feet above sea-level and on varying soils; the opportunities for observing the growth of trees under different conditions are therefore excellent. Every facility is given by Mr. V. F. Leese, Deputy Surveyor of Dean Forest, to enable the students to obtain practical work of every kind in the forest. At the end of the course, the students are examined both in the class-room and in the forest by Mr. E. P.

Popert, Consulting Forester to the Commissioners of Woods, and successful students obtain a certificate of proficiency, signed by the Commissioner of Woods.

The school thus offers excellent opportunities for the sons of foresters and woodmen, while land-agents having promising young men on their estates, can send them to the school to be trained, and can arrange that they shall return to their previous situations after leaving.

Applications from men desiring to enter the school in November are now being received, and may be sent without delay to V. F. Leese, Esq., Whitemead Park, Parkend, Lydney, Gloucestershire, from whom full particulars can be obtained. If applications for the services of trained men are received, every endeavour will be made to recommend a man who appears suitable for the situation.

C. O. HANSON.

RULES FOR ADMISSION OF STUDENTS.

1. The school is for working youths and men only.
2. Only those willing and capable of performing the ordinary work of a Crown labourer will be received. When not in school they will have to work in the woods or at any work ordinarily done by the Crown workmen, and will be under the same regulations as Crown workmen.
3. Students must be between the ages of 20 to 25, inclusive, on the date of admission. Students over this age will be admitted only under special circumstances.
4. For the present the number of students to be admitted in any one year is limited to twelve.
5. These twelve places will be first offered to young men already in the Crown employ, whether in the Forest of Dean or elsewhere.
6. Vacancies, after providing for persons in the Crown employ, will be open to others.
7. Students pay all travelling expenses to and from the Forest of Dean.
8. The following are the rules as to pay:—
(1.) *Students already in the Crown employ in Dean Forest will,*

while at the school, draw the same pay as they are already receiving for days not spent in school. On school days (two days a week) they will also receive this pay if it does not exceed 2s. 6d. a day; but when the class is engaged in planting, thinning or other work of direct benefit to the forest they will receive full pay.

- (2.) *Students already in the Crown employ on estates other than Dean Forest* will, while at the school, receive 8s to 10s. a week, according to qualifications, from the Dean Forest Funds. The Deputy Surveyor or Crown Receiver of any other Crown estate may, however, recommend promising students for an additional allowance to be paid from the funds of that estate, on condition that the student agrees at the end of the school course to return to work on the estate which has paid the allowance. The amount of the allowance will in each case be decided by the Commissioner of Woods and Forests.
- (3.) *Students not already in the Crown employ* will be paid 15s. a week.

- (4.) No student will get any increase of pay while at the school.
- (5.) On days when, owing to the weather, no work can be done, no pay is given, the rule "No work, no pay," being strictly adhered to. On the average, students lose about twelve days' work and pay in the year on this account.

9. Board and lodgings can be found in the forest at from 11s. to 12s. a week.

10. No charge is made for the education given, and all necessary books and stationery will be supplied by the Crown, but axes and other implements, except felling-saws, must be provided as required by the students. These usually cost about 15s. in all.

11. The course of lectures will extend over a period of two years, beginning in November in each year.

12. The instruction given will extend over the whole subject of forestry, theoretical and practical, including subsidiary

subjects necessary to a forester; the instruction given in the class-room and forest is designed to make a student thoroughly qualified to act as forester or woodman on any estate in the United Kingdom.

13. Periodical examinations will be held by the instructor, and by E.P. Popert, Esq., Braceland, near Coleford, Gloucestershire. At the end of the course a final examination, theoretical and practical, will be held, and certificates granted to students who satisfy the examiners. These certificates will be signed by the Commissioner of Woods and Forests.

14. The fact of having successfully passed the school examinations will give no claim for promotion in the Crown service. Ordinarily, other qualifications being equal, a passed student will be preferred for promotion over a man who has not been through the school course.

15. Misbehaviour or unsatisfactory progress during the course of study will render a student liable to immediate dismissal from the school.

16. If applications for trained men are received from private estates, these will be offered to any student deemed suitable, but no guarantee of employment at the end of the school course is given by the Crown.

17. All applications for admission should be addressed to V. F. Leese, Esq., Deputy Surveyor, Whitemead Park, Parkend, near Lydney, Gloucestershire, and should be received by him before 30th September in any year.

ON THE PLANTING AND RECLAMATION OF MOORS AND BOGS IN BELGIUM, WITH SPECIAL REFERENCE TO THE USE OF ARTIFICIAL MANURES.

1. In the Eastern provinces of Belgium, in addition to 140,800 hectares of grass, of which it is estimated that 50,000 hectares, on marshes or on ground that is merely too wet, require draining, there were in 1900 9,573 hectares of uncultivated swamps; or, in round numbers, since areas of less than 5 hectares have not been reckoned—about 10,000 hectares in

all. With the exception of 350 hectares in Namur, the area is almost equally divided between the provinces of Luxemburg and Liège. In the last province, out of 4,646 hectares, no less than 3,759 hectares are in the basin of the river Vesdre, of which only 209 are in private hands, so that there is a large area under public control, which affords an excellent field for systematic reclamation on a large scale and on most thorough and scientific lines. The royal forest of Hertogenwald, with which this part of the article will deal chiefly, is situated in the basins of the Helle and Gileppe, tributaries of the Vesdre.

In addition to the area of forest growing under normal conditions of soil, it comprised an area of 1,813 hectares of high plateau swamp, either blank or covered with a miserable crop. It adjoins 697 hectares of communal land in the valley of the Gileppe, so that there are 2,510 hectares, *i.e.* 6,200 acres of land to be reclaimed.

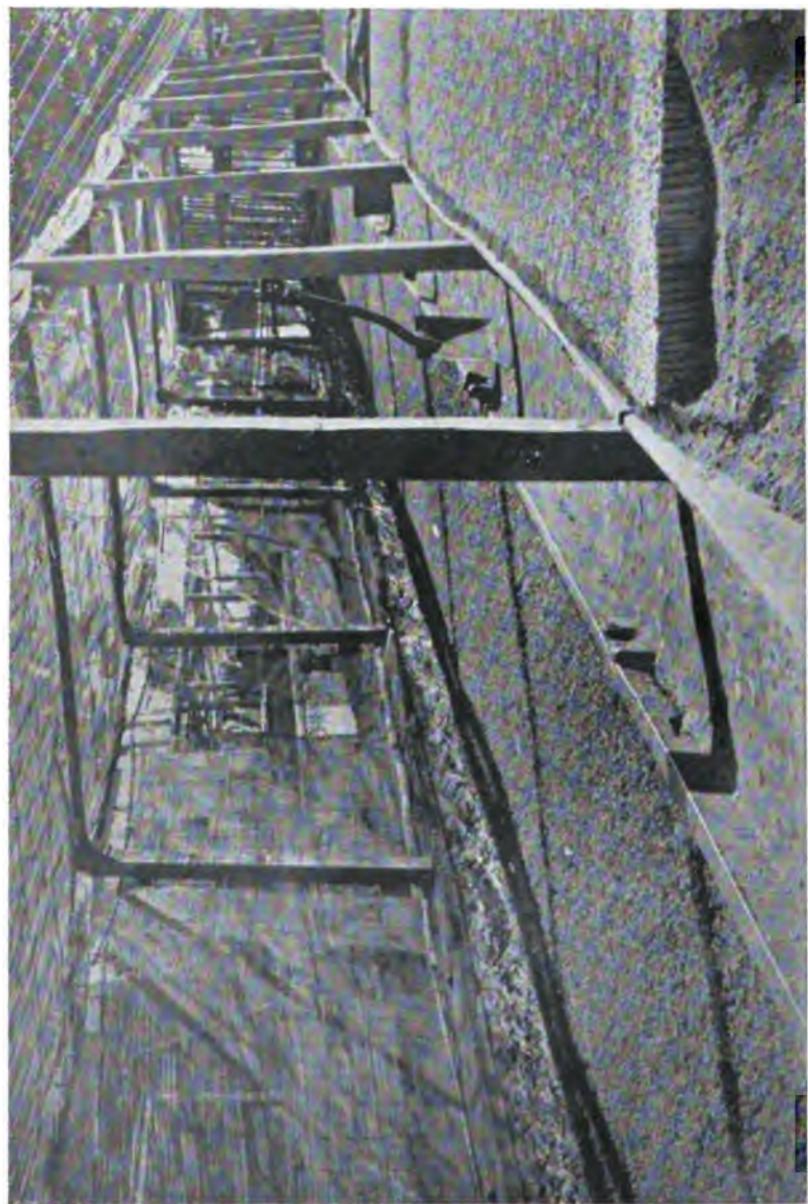
The history of the attempts to deal with the problems of draining and reafforestation in the Hertogenwald is shortly as follows:—

A beginning was made in 1836, between which date and 1864, according to official documents now stated to have been much exaggerated, more than 2,200 acres of blanks were drained and planted (mostly with conifers); main drains, traces of which scarcely exist to-day, were constructed both in the plateau swamps and in the forest proper *pari passu* with the exploitation of the felling areas.

In 1864, the result was said to be the more rapid run-off of water after rain, with a diminished flow at other seasons, a situation which led to the construction of the famous reservoir of La Gileppe.* Owing to this conclusion the drainage walls were almost entirely stopped. However, in 1864, the Longchamps swamp was taken in hand, and in 1878, after 500 acres had been drained, the Government resolved to adopt the Prussian system and push on the work more rapidly.

This system consisted in making ditches 20 inches broad and 10 to 12 inches deep, at 13 feet apart, and following the line of greatest fall; these led into larger drains, $31\frac{1}{2}$ inches by $19\frac{2}{3}$

* Which supplies the town of Verviers.



W. Gill.]
Plate II.—Shadehouse, Bundaleer Forest, showing Bamboo Tubes plunged ready for Sowing. (Vide p. 311.)

inches, which either led into main drains, 1 meter wide, or into a natural stream.

In the autumn of 1879, a violent storm occurred in this region, turning the streams into torrents which washed down enormous stones, and made many new ravines, and generally causing such damage that, as there was a general opinion that draining these plateau swamps would endanger the water-supply and the regulation of streams, the Government determined to submit the whole question to a Commission.

The Commission reported in 1883, and amongst other recommendations, advised the reduction of the area to be drained annually to $\frac{1}{80}$ to $\frac{1}{80}$ of the whole.

This conclusion gave an additional check to the draining of the swamps of the Hertogenwald, so that by 1900 there were still 4,480 acres left untouched. However, other swamps elsewhere had been drained successfully and planted during this period, and the experience gained there did not justify the fears anticipated with regard to the Hertogenwald, though one has to be careful about any drains that follow the slope of the ground.

On this subject the Commission, which sat in 1900, reported that afforestation—often the only possible method of land reclamation on these plateau swamps—would render the critical period after draining a purely temporary affair on account of the less complete draining required, the neglect into which the drains may be allowed to fall when the plantation is established, and its own regulating influence on the water-supply.

The Hertogenwald, which is the highest portion of Belgium, lies at an altitude of between 1,000 and 2,000 feet, and for this reason the spruce* is the most suitable species, for the young plant only requires to be placed on a ridge or mound made from the earth out of the ditches, so that the roots do not go down to the level of the stagnant water. It is not

* The Commission notes that "when frosts are dangerous Scotch pine must be used, which requires more draining, later it can be underplanted with spruce. Weymouth pine succeeds very well when game is not too plentiful, in which case Sitka spruce can be tried. Later, why should not the beech be introduced?"

necessary to drain all the top soil or to ensure that rain-water runs off rapidly.

The Commission quotes the following example, among others, to show that such works pay :—

In 1845, a very bad swamp in St. Ode was drained (not very completely) and planted with spruce. The ground, which was then almost impassable, has shown no signs of moisture for a long time. The spruce at some distance from the ditches were badly developed, and only numbered 700 per hectare ; yet seven years before, when the plantation was forty-eight years old, the value was estimated at £68 per acre, with an average annual income of £1. 15s. 6d. per acre.

The cost of draining and planting was £2 3s. per acre, and the land before treatment was almost valueless.

Peat bogs, from which peat can be extracted economically, when this has been done, can be reclaimed to other uses. If the land can be drained it may then, as is generally the case in Denmark, be turned into meadow, irrigated or not, or if it is not possible to drain the whole of it economically, those places where water lies stagnant can be made into regular lakes. The Danes do not as a rule plant such land, because only alder and spruce thrive, and it pays better under grass, especially after the addition of lime and marl, sometimes sand, together with basic slag and kainit. The Danes do not use artificial manure when planting land of this description, but the Belgians do, hence they are more inclined to plant on peat bogs. Where the peat is deep, spruce often languishes, probably due to acidity of the soil ; accordingly, in Belgium, the addition of lime was recommended.*

Since then, in the Hertogenwald, a compost of soil and basic slag round the roots of each spruce has been used as well.

Forty-two pounds of basic slag are used for 1 cubic yard of compost.

Basic slag costs 60 fr. per metric ton (= £2 8s. 6d. per ton) delivered on the ground ; about 10s. worth of compost is used per 1,000 plants, which are usually placed 2½ by 1½ meters (this is almost exactly 1,080 plants to the acre).

* But lime is less used in reclaiming moorland than formerly.

As the chief cost of the compost is in the slag, this works out to about 12 to 27 gr. per plant, average 20 gr. For a further description of the drains and method of planting see the notes on the tour of the Royal English Arboricultural Society in the Forest of the Hertogenwald in 1905.

The minor drains, when placed at 4 meters = 13 feet apart, have a total length of 2,500 meters per hectare (or about 1,100 yards per acre), a maximum which is not exceeded. These minor drains lead into larger trenches, which follow the secondary slope of the ground down to the larger drains or natural outlets. The Prussian system employed about 400 meters of these trenches per hectare, or about 180 yards per acre, but the length now depends on the nature of the ground.

The minor drains were originally $31\frac{1}{4}$ by 12 inches, the breadth of the bottom being 20 centimeters, but are now deeper in the peat, up to 2 feet and more.

The larger trenches were made $39\frac{1}{2}$ by $15\frac{3}{4}$ inches, also 8 inches broad at bottom. These are now deeper in places where there is much turf.

Labourers cost 3 fr., or 2s. 6d., a day for men; and 2 fr., or 1s. $7\frac{1}{2}$ d., a day for women, and with the minors 13 feet apart, draining costs about 33s. per acre, increased by 25 per cent. to 50 per cent. more where extra deep trenches are required for deep peat soils.

The minor drains should be slightly inclined to the natural slope of the ground, being intercepted by the larger trenches which lead obliquely into the collecting drains or natural outlets.

It is hoped that the figures given will be some guide to the cost of a similar system if adopted elsewhere.

The spruce, of course, being planted widely apart, for the cost of the operations and the necessity for the plants to be near the drains limits the number that can be used, take some time before they are established—but those inspected seemed healthy, though none of these plantations are old, having been begun in 1900. They are planted thicker on the borders of the compartments and mixed with other trees, especially Sitka spruce and *Picea alba*. The latter forms an excellent mixture with spruce on poor soils or exposed situations, it

being frequently used in such places in Denmark with great success. The Belgians would use it more, but plants are still expensive. It is more wind-firm, and makes less demand on the soil than the common spruce, and, though to a lesser degree than the mountain pine, seems to have a similar beneficial effect on spruce when mixed with it. I do not know whether, as in the case of the mountain pine, this is due to a mycorhiza on the roots. There seems no doubt as to the suitability of this species, but *Picea Sitchensis* and *rubra*, which are also used on peaty soils, have still to be tested. Away from the peat other species as *Pinus Cembra*, Weymouth pine, alder, and birch are used as wind-breaks to the spruce.

During the three years that have elapsed since the Society visited Belgium it is clear that the work has progressed methodically, and that it has been so far successful and gives every promise of continuing to be so. Apart from the draining, the good results are due to the employment of basic slag, which both helps to correct the acid of the peat and furnishes a necessary constituent to a soil poor in other minerals, except potash. The only places where I have heard of the use of basic slag in England, in this way, is on some of the plantations of the Midland Reafforesting Association, about which no statements have, I think, yet been published.

These spruce plantations on drained bog are very subject to forest fires. Consequently, broad fire-traces are used, ranging from 60 metres, or nearly 200 feet, to 36 and 33 feet broad. The broadest lines are given 1,500 kilos. basic slag per hectare, or about 6 cwt. per acre, and sown with 150 kilos. of grass seed, which costs 30 fr., or in English measure with about 130 lb. seed per acre, costing 9s. 6d.

For the smaller fire-traces only 4 cwt. basic slag per acre is used.

Formerly the top soil on either side of the trace was stripped off and thrown on the middle, but this is not now considered good practice, as the grass does not grow well when the vegetative soil is removed, and the bare soil is soon re-covered with heather, sedges, or reeds.

When possible the grass is grazed, but when far from farms this cannot be done, and the grass is sold for cutting to con-

tractors. What they reject is then cleared by the department. It is consequently of some importance to grow useful grasses on the fire-traces.

Not far from the highest point, a small arboretum by the Barraquement de Durhet had been planted with exotic species. Here at 1,900 feet, on clay soil, *Abies Nordmanniana* did best, then *Picea Engelmanni*, afterwards Weymouth pine. *Picea alba* was healthy, but small—it is, of course, a slow-growing tree. On clay one would expect silver firs to do better than spruce, if they thrive at all. This arboretum is interesting, since it shows that though, of course, the various species of spruce are the best for first planting on swamps and bogs at high altitudes, yet when the draining and planting has dried the ground, other valuable kinds of pines and firs can be introduced. The writer remembers a very healthy spruce plantation at an altitude of over 1,000 feet at Vyrnwy, in N. Wales. Spruce is evidently a tree for poor soils at high altitudes, and, if grown in sufficiently large blocks close to one centre, 10,000 acres would supply one pulp mill and allow a fair return to be made after twenty years, or even before. The one danger, wind, can probably be effectively guarded against by suitable wind belts of *Picea alba*, Austrian pine, or mountain pine, according to soil and elevation.

II. With regard to bogs and marshlands in the valleys, due to the water-retaining power of organic detritus on an unpermeable subsoil, with a feeble slope to a stream, they require draining only, unless the fall of the stream is itself too low, when it will require rectifying. The Commission on the draining of bogs reports many striking examples of the reclamation of such lands by draining, the use of basic slag and phosphates, the levelling of the fields, and by the regulation of the streams so that they can serve as irrigating channels in droughts as well as drainage channels in ordinary seasons.

The land is mostly reclaimed to pasture and arable, but could obviously be planted with success.

These bogs and marshes were not visited, and they are mentioned here only to show that the Belgians have not neglected the careful study of reclaiming all such lands, no matter in what situation they occur. The examples given by the Com-

mission show that very bad bogs have been successfully reclaimed at a cost of £12 to £16 per acre.

When travelling from the Hohe Venn or Hautes Fanges to the Campine, a stay was made at Charleroi, to visit some pit-mounds that had been planted about twenty years ago.

The soil was broken schist from the coal measures, very dry and porous, with only traces of lime and clay.

On one pit-mound trees grew best in the order named: *Robinia Pseud-acacia*, birch, maples, sycamore and Norway maple, alder (grey and black).

Ash, both mountain and common, also thrived. As a guide to what growth can be expected with birch, standards in twenty years were 13 meters high, or over 43 feet, with a circumference of 12 $\frac{1}{2}$ to 16 inches at breast height.

Another mound covered with twenty-year-old *Robinia* and a few birch and forming a fairly stocked high forest showed an average height of 11 to 12 meters, or 35 to 40 feet, with a girth of 12 inches.

However, since cypresses flourished and the atmosphere was not too bad for the spruce to maintain itself alive, the problems to be solved were not so difficult as in our own Black Country. Even here, where the plantation is large, it seems clear that the trees on the borders will protect those in the middle.

III. The dry sandy heaths and the marshes of the Campine.

The Commission which investigated the improvements and reclamation of these lands reported at the end of 1904 as follows:—

The Campine, a vast low plain with a gentle slope, which extends over the greater part of the two provinces of Antwerp and Lemberg, is characterised by a sandy soil, generally poor, and very dry at the greatest altitudes or on the higher levels, but often very wet and even marshy in the low-lying parts, both in natural hollows or wherever there is an impermeable stratum at a moderate depth in the subsoil. This layer or pan (*tuf*) is known as iron tuf, or humic tuf, as the case may be. Humic tuf is the most objectionable, and is caused by humic acids in excess resulting from the decomposition of the superficial organic matter.

These acids sterilise the upper layers of soil and combine

with the salts taken from it into compounds, which are not suitable for plant life.

Moreover analyses show that the soil of the Campine is usually deficient in nutritive material, or that it does not exist in forms that plants can assimilate.

Under the economic conditions, former methods of agriculture on a large scale were only possible on account of the constant supply of material from the moors and woods to the cultivated land, which constituted the practices of heather grubbing and the excessive removal of pine needles for litter. At the agricultural census at the end of 1895, these two provinces contained more than 190,000 acres of uncultivated land, of which 99,000 belonged to private landlords, 79,000 to communes, and 12,000 to the State. More than 93,000 acres were underwood, 79,000 belonging to private owners, 13,000 to communes, and the balance to the State. But these are generally unthrifty pine woods, badly planted, often treated without any silvicultural rules, ruined by the excessive removal of litter, and which must be clear cut at an early age.

Out of the total of 420,000 acres of waste land and woods recorded in 1895 to be improved and reclaimed, the Commission considered that 123,000 should be treated as arable and pasture (about half-and-half) and 222,000 as forest.

The improvements required are:—

Draining, irrigation, trenching, manuring, and occasionally fixation (of moving sands).

Proper draining often calls for State intervention. Irrigation is only practicable in a few cases.

Trenching is necessary to get rid of any impermeable layer in the subsoil, but though useful is to be avoided when possible on account of the cost. Silviculturists have often exaggerated its importance when it would have been sufficient to till the surface of the ground thoroughly, making drains where required, expense being preferably incurred on the addition of manures. In order to fertilise or improve these lands for agriculture or forestry recourse is had to artificial manures, sometimes to road scrapings and town refuse,* or both together; or better

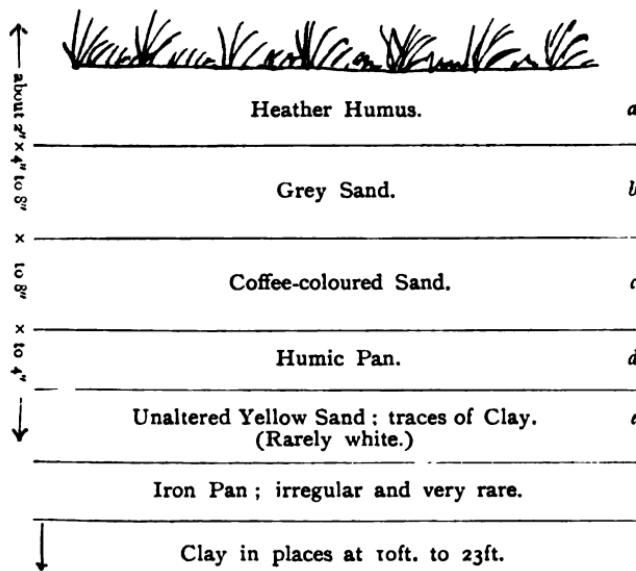
* Often objectionable owing to the quantity of seeds of weeds they contain.

still to artificial combined with green manures, especially lupins. In the last case catch crops, especially barley, can be reaped, which will materially diminish the cost.

*The use of basic slag and kainit, also of lupins, has become part of modern practice for the planting and reafforestation of the Campine, and has already given satisfactory results.**

The recommendations of this Commission were based partly on experience gained on the Government lands—1977 acres—at Raavel Pont, near Turnhout, which have been taken in hand now for some years, the oldest plantations being now three years old. Eighty hectares, or nearly 200 acres, are taken in hand every year. The following is a section of a very common type of soil on this estate:—

CAMPINE SANDS.
SECTION OF THE MOST COMMON TYPE OF SOIL.



A. P. G., Del.

N.B.—Layer *c* is often indistinguishable from layer *d*.

* Written in 1904. The practice may now, 1908, be regarded as customary on this class of land as the expected results have been more than attained.

The layer of humic pan is due to the organic matter being washed down through the upper layer of sand to the level of the unaltered yellow sand, where it combines with the iron oxide and clay of the latter, together with the salts brought down in solution to make this particular formation. The humic tuf forms a compact layer, more or less hard, sometimes very hard; sometimes it is mixed with sand, when it is much less hard and compact; in this state it is apt to be confused with the upper layer, for there are no hard and fast divisions between the different layers.

Analysis shows that the humic tuf contains more iron oxide and alumina than the yellow sand below, and eight times as much as in the upper layers, while it has thirteen to eight times as much phosphoric acid as the upper layers.

Found over a great extent of country, it generally lies 12 to 16 inches and more below the surface, but the better soils are characterised by its absence.

This formation is not found in the swamps. At the Government plantation at Raevels Pont the system of culture on the poor heaths and swamps was as follows:—

1st year.—Draining as required.

2nd year.—Plough at least 25 centimeters, or 10 inches, deep. Lime added before ploughing, and afterwards 1,200 kilos. of basic slag and 300 kilos. of kainit per hectare, or nearly 10 cwt. of slag and 2½ cwt. kainit per acre. The lime is mostly used on the low-lying and marshy, and, consequently, more acid soils, to 25 metric tons per hectare being used, or 2 to 10 tons per acre.

3rd year.—Till ground and sow lupins during end of April and May, using 125 kilo. seed per hectare, or $\frac{1}{2}$ cwt. per acre. Plough in when in flower end of July to August.

4th year.—Second crop of lupins, using 90 lbs. seed. Plough in as before, or during August and September. Plant broad-leaves in the moist hollows and richer soils during autumn.

5th year.—Plant conifers in the spring.

6th year.—Beat up blanks and clean young plants.

The second crop of lupins is necessary, since the first is often a comparative failure. The necessity for the first crop can be obviated by inoculating the land with 2 tons per hectare (or

over 16 cwt. per acre) of soil taken from a field with a good crop of lupins, but the simpler plan is to grow two successive crops. The yellow lupin is most used, though several varieties and species are being experimented with. The compartments are 10 to 15 acres in size, with rides, 6 meters, or 20 feet, broad between them. A breadth of 20 feet round the compartments is planted with broad-leaves to guard against fire.

The ruling species is *Pinus sylvestris*, though in certain cases *P. maritima* and *P. Laricio* (Corsican) are recommended. The objection to the former is its liability to damage from frosts, and the difficulty of transplanting the latter when young. Besides these, mixed with the broad-leaves on the edges, *Picea sitchensis*, *Larix leptolepis*, *Pinus Strobus*, *P. Banksiana*, *P. rigida*, etc., are being tried, also Douglas fir, *Tsuga mertensiana*, and *Taxodium distichum*. The pines are planted in rows as one-year seedlings, 1 meter apart, and 70 to 80 centimeters in the lines.

Larix leptolepis are planted at 1 year, 2 years, and *Picea sitchensis* are planted at 2 years, 1 year, 40 inches by 28 to 31 inches.

Scotch, Scandinavian, and Haguenau seed has been tried. Scotch is very good, but expensive. Haguenau seed is mostly used, but it is expected that the best results will be obtained later from acclimatised trees.

The broad-leaves, placed in order in which they appeared to grow best, are: Robinia, black alder, grey alder,* *Salix alba*, *S. caprea*. Less good were: *Quercus rubra*, common and sessile oaks, *Prunus Virginiana*, and chestnut. The red oak and Virginian cherry have been recommended for the sandy soils of the Campine, where they seem to do very well. The plants were mostly very healthy. Scotch pine, three years planted, had shoots of $\frac{1}{2}$ meter, or nearly 20 inches; Robinia was $2\frac{1}{2}$ meters (over 8 feet) in three years; Alders still more; *Larix leptolepis* in third and fourth years was making shoots 1 yard long.

Every 5 meters, or between every fifth row of conifers, the space between the lines was $1\frac{1}{2}$ meters, to allow of drains being

* The grey alder is a nitrogen producer having nodules on the root. These have been frequently noticed on the common alder used by the Midland Reafforesting Association, and may also be due to nitrogen bacteria.

opened later on if required (probably in seventh or tenth year of plantation). These drains will be 1 meter broad and 20 centimeters deep, 20 to 30 centimeters wide at bottom, being deepened as required to 60 centimeters. Earth will be thrown loosely between the ditches, and lime added in moist places.

It is clear that the planting of one-year-old Scotch pines would not succeed unless the ground was thoroughly clean and a good tilth obtained, when very small plants can be used; a practice which was successfully adopted in large plantations in the Transvaal. Draining all the ground, with the exception of those places that obviously require it, is to be deferred until the trees, having struck down to an impermeable stratum or stagnant water, are seen to require it; meanwhile they flourish splendidly on the carefully tilled and enriched upper soil.

Conifers planted pure such as these are somewhat liable to disease. The only one noticed was *Hysterium Pinastri*—which defoliates the young plants—but this can be checked by spraying at the proper time. For the rest dependence is placed on the small size of compartments, their isolation and mixture by groups with broad-leaves.

The total expenditure was given as per hectare:—

	Fr.
Cost of land	95
First ploughing	48
First cultivation of lupins	55
Second ditto	50
Basic slag, 1,200 kilos.	60
Kainit, 300 kilos	15
Lime at 4 to 5 fr. per ton, some quicklime at 9 fr., say 3 tons per hectare in all	15
Plants at 1 fr. per 1,000 = about 13,000 per hectare (over 5,000 per acre)	13
Cleaning and various expenses	20
Draining (average cost to date)	10
 Total	 381

or £15 5s. per hectare, or about £7 10s. per acre.

The total cost has certainly not been more than 400 fr. per hectare to date, or about £8 per acre.

Wages run 25 cents per hour for men, and 12.5 cents per hour for women, with a ten hours' day.

The ploughing is mostly done by contract.

If additional draining and more lime is required the cost will of course be raised.

Those parts of the marshes which could not be conveniently drained were being converted into ponds, so that the whole area was being systematically reclaimed.

Had these been private lands the reclamation, instead of taking four whole years, would have been prolonged to six, to allow of two crops of barley being taken before planting so as to reduce the amount of capital locked up.

The contrast between the sandy heaths with a scanty growth of ling (*Calluna vulgaris*) and the swamps covered with cotton grass, sedges and sphagnum, and the thriving young plantations on what had once been similar ground, was most striking and gave eloquent testimony to the foresight, energy and intelligence of those responsible for the work.

Since on land that has already been reclaimed the species mentioned thrive well under proper silvicultural treatment, there is no need to fear for the future success of these plantations.

It should be added that the Campine is a very wind-swept plain, and that the climate, though near the sea, is more continental than marine, so that other conditions besides those of soil are unfavourable.

There can be little doubt that, if our Irish and Scotch moors and bogs were examined and reported on by experts with a view to planting, it would be found by adopting modern practice to our special conditions that large areas now considered unsuitable could be successfully planted with thriving woods, if care is taken at first to avoid mountain slopes close to the sea and exposed to the full fury of the Atlantic gales, or soils where the peat is more than 6 feet deep, such as the plantation of Knockboy, which had all these and, possibly, many other disadvantages.

The special features of Belgian practice are the careful

analysis of the soil and the use of artificial manures in forestry. At Raevels Pont there is good canal, tramway and road transport, but this does not apply to the "Hautes Fanges," which are many miles from the nearest railway station and not always intersected by good roads. However, even here basic slag only cost one-fifth more than at Raevels Pont.

Land reclamation on a large scale in the United Kingdom appears to have fallen into abeyance for many years past; it is therefore probable that we may now have something to learn from the latest practice of our neighbours.

Your contributor's thanks are due to the Belgian forest officials whose courtesy and assistance enabled your contributor to make a tour of exceptional interest in a very few days.

SPECIFICATION OF DRAINS IN THE HERTOGENWALD HAUTES FANGES.

Ditches and (minor) drains are to have the following dimensions:—

1. Compartment ditches, 1.20 m. by .50 deep and .20 at the bottom.

2. Main drains same size as preceding, or 1 by .40 by .20 m.

3. Minor drains .80 by .30 by .20, or .60 by .30 by .20. Material from excavation to be placed in straight lines; mounds and heaps are not allowed.

Minor drains to be from 4 m. to 6 m. apart centre to centre. Earth from the compartment ditches to be thrown inside the compartment; that from main drains to be placed on both sides, leaving on the upper side a space of $\frac{1}{2}$ meter at every 5 meters, permitting the free flow of water. The material from the minor drains to be placed on either side (the turves being reversed) 1.50 m. apart on 2 or 3 equivalent lines, counting from centre to centre. The turves are to be arranged quincunzewise.

CAMPINE. SOIL ANALYSIS OF THE DIFFERENT LAYERS.

One thousand parts of dry earth from each of the following layers contains, according to Mr. Bradfer :—

	Superficial layer.	Grey sand.	" Tuf."	Yellow sand.
Organic matter	45.60*	13.10	35 to 43	0
Total nitrogen†	1.626	0.89	0.721	traces
Oxide of iron and alumina	1.90	0.85	8.10	7.30
Lime	0.70	traces	1.70	traces
Potash	0.10	0.10	0.20	0.30
Phosphoric acid	0.061	0.06	0.83	0.09
H_2SO_4 (sulphates) ...	0.626	0.62	0.69	trace
Chlorine	0.029	0.02	0.02	trace
Total silica	940—950	960—980	950—960	960—980

* Heather roots and various decayed matter of a peaty nature, all being very slow to decompose.

† Only traces of ammonia and nitric acid.

N.B.—Column 3: In this instance the third and fourth layers were not distinct, and only averaged 6 cm. thick.

ANALYSIS OF SOILS FROM DIFFERENT PARTS OF THE CAMPINE.

100 parts of fine earth contain :	Sandy heath of Moll.	Heath of Mexplas.	Soil from de Genck Heath.	
			Soil 0.20 c. m.	Subsoil 20—40 cm.
Combustible and volatile matters	24.25	26.06	18.75	28.59
Organic nitrogen	0.42	0.47	0.14	0.16
Ammonia	0.64	trace	0.02	0.02
Nitric acid	trace	trace	trace	trace
Soluble in cold HCl density 1.18	5.73	8.06	4.31	14.52
Oxide of iron and alumina	3.24	7.15	2.52	13.23
Lime	0.25	0.19	0.25	0.04
Magnesia	0.06	0.11	0.03	0.10
Soda	1.71	0.25	0.64	0.53
Potash	0.05	0.05	0.03	0.02
Phosphoric acid	0.15	0.10*	0.13*	0.28*
Sulphuric "	0.11	0.10	0.09	0.13
Carbonic "	—	trace	0.37	0.00
Silicic "	0.16	0.10	0.24	0.18
Chlorine	trace	0.01	0.01	0.01
Insoluble in cold HCl , Soluble in HfI	970.02	965.88	976.74	956.89
Potash	6.68	27.96	1.79	2.47
Lime	8.65	10.27	4.52	11.13
Magnesia	—	0.61	2.42	3.06
Phosphoric acid	1.26	0.02	0.22	0.08

* All soluble in alkaline citrate of ammonia.

HAMBRIDGE, Sept. 9, 1908.

A. P. GRENFELL.

Obituary Notice.

MR. F. B. MANSON.

WE regret to state that Mr. F. B. Manson, a former life-member of the R. E. A. S., died at Oxford early in August. He joined the Forest Service in India, in January, 1876, when his present Majesty, then Prince of Wales, was visiting India and the celebrations were taking place of the Queen's new title as Empress. His forestry training was at Nancy, where he made warm friendships with professors and fellow-students. He was posted at Bamano pukhari, about eight miles below Kurseong, in the Darjeeling Terai, living in a neat little bungalow in the dense jungle on a shoulder of the hills, and thoroughly enjoyed his work and all the activity which it entailed—one time a hasty scramble up hill or down through the jungle to combat a fire, another time roaming for days with Lepcha coolies on some survey or other work and the slenderest imaginable commissariat. Some year or two before experiments had been made to test a theory, by planting *Ficus elastica* upon the branches of forest trees. Manson was ordered to inspect and report on the growth made by these plantings, and he found only the vaguest indication to guide him where to find them. He set to work, therefore, to climb up all the forest trees in the area indicated, to hunt for the youthful rubber plants. Clambering up a tree or down a precipice, or crouching in a hole while a jungle fire went over him, or wading thigh-deep up a watercourse to explore for some almost impossible survey—such things all came into the day's work, and this sort of hard-headed fighting through difficulties in every detail was the line he invariably took. He remained in the Darjeeling division for many years, and settled many boundary disputes with tea-planters, dealt with the fuel-supply for Darjeeling and much work of organisation, his happy temper with Europeans and natives alike being always of great value in getting work done. While attached to the Darjeeling division he was entrusted with the compilation of a working-plan for the forest around Darjeeling,

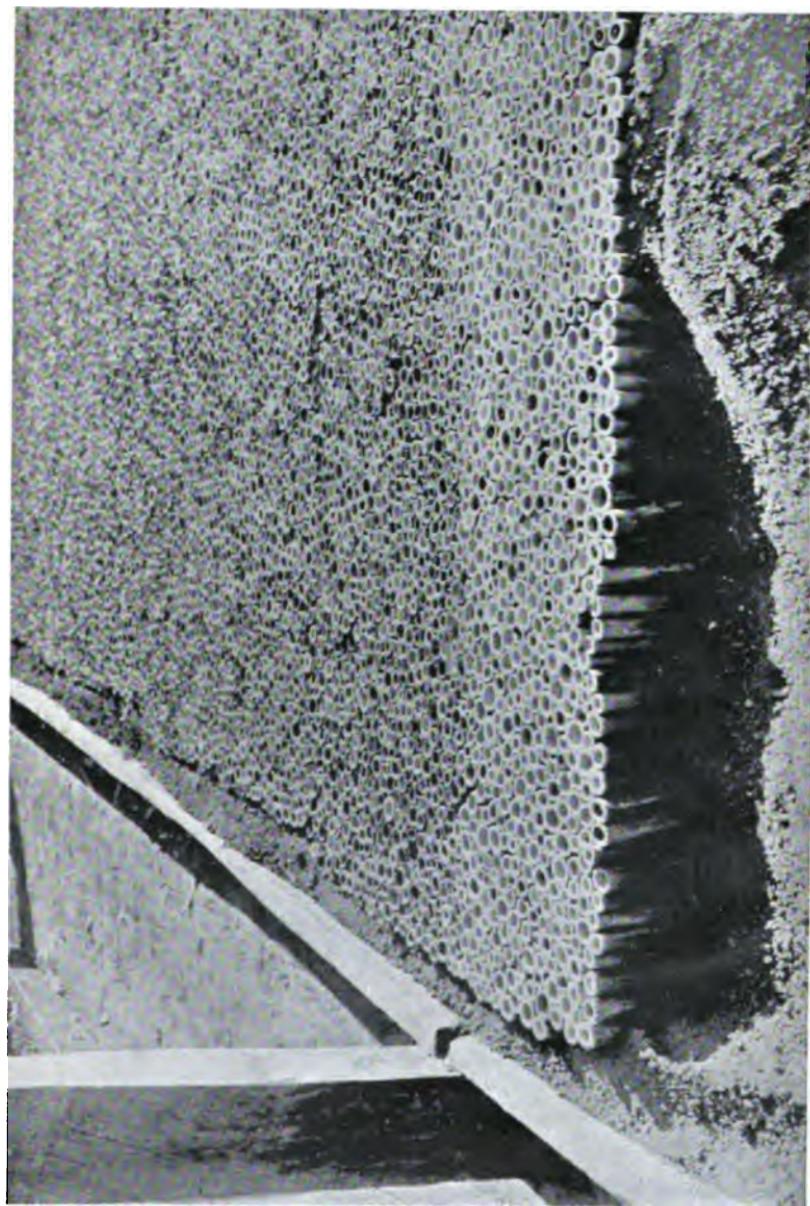
and so thorough and capable was his work in this direction that he produced one of the most complete and scientific plans of that time. In April, 1883, he was promoted to be Deputy Conservator of Forests, and for some years had the chief charge of the Darjeeling division, which he worked under the plan he himself had made. He also constructed a wire rope-way for the transport of fuel over one of the ravines near Darjeeling—the first of its kind in Bengal. His services were often recognised by Government, and in August, 1898, he was transferred from Bengal to Burma and was made Conservator of Forests of the Tenasserim Circle two years later. While in Burma he sent botanical specimens to Kew and to the late Sir Dietrich Branic from Tenasserim and the Siam border. Some of the species were quite new. In 1898 much interest was awakened in England about the supply of rubber, and reports were called for both as to indigenous rubber plants and the possibility of growing *Hevea brasiliensis* and other kinds (*Castilla*, Ceara rubber, etc.) successfully in Burma on a commercial scale. Manson wrote strongly recommending the project, and was ordered to carry it out. In spite of many difficulties in regard to labour, the supply of seeds, injury to the plants and bad weather, a fairly large area was planted before he left Burma. He retired in January, 1906, and settled in Oxford, but did not live long to enjoy the pension which he had duly earned by so many years of good and honest work.

Reviews, and Notices of Books.

STEBBING'S INDIAN FOREST ZOOLOGY.*

THE writer of the "Manual of Forest Zoology," Mr. E. P. Stebbing, is a son of the Rev. T. R. R. Stebbing, F.R.S., the author of the volume on Crustacea in the International Scientific Series and the best living English Carcinologist. Mr. E. P.

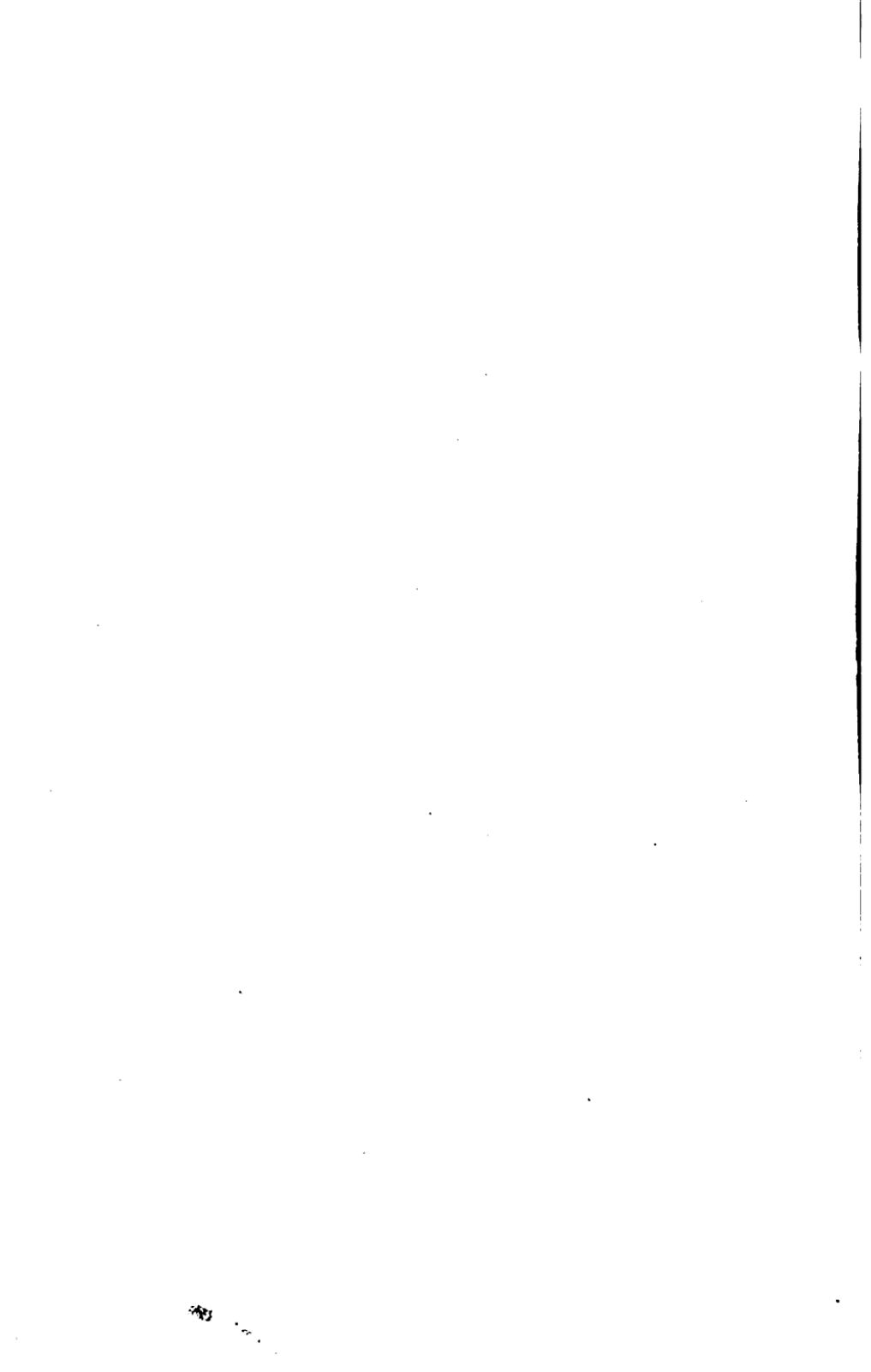
* "A Manual of Elementary Forest Zoology for India," by E. P. Stebbing, F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist to the Government of India, Calcutta. Superintendent of Government Printing, India 1908. Price, Rs. 10, or 15s.



W. Gull]

Plate III.—Closer View of Section of same. (Vide p. 311.)

[Photo.



Stebbing studied entomology under Mr. W. F. H. Blandford, at Cooper's Hill; the latter was then Secretary to the Royal Entomological Society, a most able teacher and an enthusiastic entomologist, and many of his former pupils who are now in India have kept up their love of entomology, and have supplied Mr. Stebbing with much of the material for his work during his tenure of the post of Forest Entomologist, which he has held since 1901, and which is now merged in that of Forest Zoologist. The book commences with a good introduction to the animal kingdom, and this is followed by a short notice of the earlier natural classes of animals, until we come to Insecta. As the practical forester is often more directly concerned with the influence, for good or evil, of the members of the insect world on the shrubs and trees that are the objects of his care, than on that of other branches of the animal kingdom, it is only to be expected that a large portion (pp. 21—167), much of it in small type, out of the 229 pages of this book, is devoted to the consideration of insects. It is, however, incumbent on Indian forest officers to know about the life-history of fishes, and of birds, and the game and other animals of the forest, so that the whole of this book is of great value to the Indian Forest Department.

It would have been interesting if, in the preface, some reference had been made to early labours in Indian Entomology by Mr. Richard Thompson, Mr. M. C. Clifford, Mr. E. Cotes, Major Bingham, Mr. R. Wroughton and others. Natives of India have not yet, with but few exceptions, shown any great zeal for natural science. One of the exceptions in the case of entomology is Mr. Nitya Gopal Mukherji, M.A., of the Indian Agricultural Department, who studied the diseases of silkworms at the Pasteur Institute in Paris, and was appointed, in 1886, by the Government of India, to conduct researches in the breeding and protection of silkworms at Berhampur in Bengal. As the cultivation of wild silkworms is a by no means inconsiderable industry in many of our Indian forests, some reference to their diseases would not have been out of place in this manual, as is done in the German forest entomology by Judeich and Nitsche. One of the greatest advantages of a book of this kind is to enable native forest officers to have a work of

reference, which will show them on what lines to proceed in research, and to foster an interest in such research.

A very good, though brief general account of the structure, metamorphoses and classification of insects is followed by a *résumé* of the orders into which the class is divided by modern entomologists, following the arrangement of Dr. Sharp in his well-known volumes in the Cambridge "Natural History" series. Under each Order the life-histories of the more important known injurious and beneficial insects of India are given, in some instances with considerable detail; indeed, this section of the book may be said to form a very useful introduction to Indian Entomology. The accounts of the habits and economy of the destructive locusts, grasshoppers and Termites, or so called "White ants"; of the formidable Indian bees, wasps and ants, and of the numerous beetles and moths, which, in their larval stage especially, commit such widespread ravages on forest trees and young plantations, make interesting reading for the entomologist at home, and will certainly be very useful to the School of Forestry at Oxford. We would specially call attention to the detailed life-histories of the usually tiny, but most destructive wood and bark-boring beetles of the family *Scolytidae*, which are perhaps the worst of all insect forest foes, and are evidently a special object of study and research by the author. The other principal Orders, though more briefly dealt with, are treated in sufficient detail to enable the student of practical forestry to recognise many of the insects, friends as well as enemies, that he will meet with in the course of his work. The plates, more than sixty in number, and mostly original, which illustrate this section of the book, though the figures are in some cases roughly, though boldly and characteristically drawn, are nearly all very adequate for their purpose. Some of them, such as Plates XXXV. and XXXVI., detailing the ravages of the longicorn beetle (*Hoplocerambyx spinicornis*) in the solid wood of the Sál tree; the metamorphosis of the "Goat Moth" (*Duomitis leuconotus*) in the stems of *Cassia nodosa* (Plate LV.), and the two beautiful plates (LXXI. and LXXII.), in which the life-history of the commercially very important Lac insect, *Tachardia lacca*, is shown in full detail, are very fine examples of entomological illustration. A considerable number

of misprints, chiefly in the names of insects alluded to, and not all contained in the Errata, will no doubt be corrected in a future edition, in which it is also suggested that it would be advisable to have two parts, one dealing only with insects, and the other with the rest of the animal kingdom. After one page devoted to Myriapoda, the volume concludes with sixty pages on the Vertebrata, in which one page is given to Fishes, three to Amphibia, eight to Reptilia, sixteen to Birds, and twenty-six to Mammals. Full acknowledgment is given by the writer to Colonel Alcock, F.R.S., of the Indian Museum, to Mr. A. E. Shipley, F.R.S., Professor of Zoology at the University of Cambridge, who formerly taught entomology at Cooper's Hill, and to the late Dr. W. F. Blanford, F.R.S. (not the entomologist alluded to above) for reading the proofs and giving advice about the portion of the manual both preceding and following Insecta, which is a compilation from a number of works cited in the preface, while the plates illustrating Vertebrata are from "The Fauna of British India," published by the India Office. Under these circumstances, it is not necessary to deal with this part of the book in detail. We merely note the remark of Leydekker, in "The Royal Natural History," that, "probably owing to a clerical error on the part of its first describer, the slender-snouted crocodile, known in India as *garial*, is spoken of in Europe as the gavial, its misspelt name having been latinised into *Gavialis*, an error which some writers (including Mr. Stebbing) persist in perpetuating, the true name being *Garialis gangetica*." The okapi is wrongly described as a member of the horse family, *Equidae*, though it is actually a form of giraffe, and allied to deer. These are, however, but minor defects in a well-executed piece of work, which will not fail to be appreciated by all who are concerned with Indian Forestry.

The Government of India would be well-advised to retain an officer of Mr. Stebbing's attainments in the Imperial Research Branch of the Forest Department, and not to relegate him to the general list of forest officers. Not only would his valuable researches be thus restricted, but an officer who has devoted the best years of his Indian service to the study of a special branch of science can hardly be expected to cope with the

administrative, technical, and financial duties, that are incumbent on conservators of forests.

MATHEY'S "COMMERCIAL UTILISATION OF WOOD."*

THE first volume of Mathey's great work on the commercial utilisation of timber was reviewed last October. The second volume was published last spring, but pressure of matter has prevented its being noticed here in an earlier number of the Journal. It is a wonderful book, representing an immense amount of labour by the author, and is a practical description of the methods employed in France for utilising wood in every form, as well as the extraction from wood and bark of tannin, resin, tar, and also the products of the final distillation of wood.

The first volume dealt with wood as a raw material, and explained its qualities and defects, the methods of felling trees, the transport of timber, and the various methods of carrying it ; it also included an account of the diseases of trees, with some splendid original chromo-lithographs. In fact, it is necessary to know thoroughly and scientifically the nature of any raw material before we can utilise it to the best advantage. The methods of using the wood that forests produce are described in the volume before us.

The whole of the material for the large second volume of the book, nearly double the size of the first volume, has been collected by the author from the usages of the timber trade, not only in France, but also to some extent elsewhere. It deals with the uses of wood ; implements employed for transforming it into utilisable material, and the classifying of this material in trade. This volume is divided into eight parts, dealing with : firewood, charcoal, paper-pulp, small industrial wood, logs and balks, beams, railway sleepers, planks and other sawn material, cloven wood, minor and principal forest industries, accessory products.

* "Traité d'exploitation Commerciale des bois." Tome deuxième et dernier. Alphonse Mathey, Inspecteur des Eaux et Forêts. Paris. Lucien Laveur, Rue des Saints Pères; pages i-xv., 836, including index, 429 plates. Price 20 francs.

In the part dealing with firewood and charcoal, a diagram is given of the prices of these materials in Paris, from 1863 to 1905, showing a steady decline in the price of firewood, but firewood used by bakers, often birch or pine wood, keeps up its price steadily. The French have not adopted ovens heated by coal, and it is very probable that their bread is all the better. A full account is given of charcoal-making, and it is stated that hot countries use most charcoal nowadays. The commercial value of paper-pulp and its classification is discussed thoroughly.

In the second part small wood industries are described—pipes, brooms, rods of all sizes; one important chapter is devoted to pit-timber, another to telegraph and telephone posts. As for pit-props, there is a wealth of information regarding their strength and quality and commercial classification.

The third part, dealing with logs, gives the best advice to the feller of trees, who, to sell his produce to the best advantage, must be thoroughly posted up as to the immediate requirements of the timber trade. Part IV. deals with the classification of timber adopted by the trade, and the specifications insisted on by different railways, French and foreign, for railway-sleepers. Part V. deals with sawmills, and the superiority of the American mills and saws over those that are European is demonstrated. The French have a great advantage over Northern Europe, where the trees are of small diameter, while in France trees of large diameter are produced; French logs can therefore be sawn "*sur maille*," which means sawn in half, and then again in half, and the pieces sawn into planks, and thus yield wood of the very best quality, and not liable to warp. Part VII. deals first with small industries—sabots, clogs, hoops, etc.; then with large industries—carriage and cart making, turnery, furniture, lucifer matches, lead-pencils, etc.

The volume closes with an account of tannin, cork, resin and turpentine, tar, the products of distillation and wood gas.

This book is indispensable both to the forester and also for the timber trade generally.

THE CROWN PLANTATIONS AT OXSHOTT,
SURREY.*

A CONCISE and clear report, with suggestions for future management of the plantations at Oxshott, Surrey, has been prepared by Mr. W. R. Fisher. It is divided into three parts. Part I.: General Description of the Locality ; Part II.: General Description of the Woods ; and Part III.: Future Management. Ample instructions as to the details of proposed treatment, management of the nursery, etc., are given, as also an Appendix with a detailed description of each compartment.

The plantations are the property of the Crown, and as copies of the report are obtainable at the Office of the Commissioners of Woods, etc., a brief notice will suffice.

The estate was purchased by the Crown in 1867, and most of the old oaks were then felled and sold as a set-off against the purchase-money. The few remaining old oaks are of large girth, but short in the bole. There are, however, plants of younger oak standards.

The Oxshott coverts, being close to the railway and only twenty miles from London, are very favourably situated, and there is a market for all wood, except thorns. Oak timber realises from 1s. 6d. to 2s. 6d. per cubic foot. There is a ready demand for ash and hazel for stakes, chestnut is split for fencing-rails or made into hoops, and birch is converted into hoops or faggots.

As in nearly all the English woodlands, there are many rabbits, but, unlike so many of these woodlands, every effort is made to keep them within reasonable numbers. Beyond these pests the only serious causes of damage are apparently spring frosts and the oak-leaf moth.

Since 1867, the woods have been worked as coppice-with-standards. Great improvement has been effected by the

* "Report on the Crown Plantations, at Oxshott, Surrey, with Suggestions for their Future Management. 1908." By W. R. Fisher. London: Printed for his Majesty's Stationery Office. Darling & Son, 34-40, Bacon Street, E. Copies may be obtained from the Office of Woods, 83, Pall Mall, for 1s. 3d., and map 1s.

cutting out of thorny bushes and by replacing them with valuable species of underwood. A considerable part (over 123 acres) still remains to be cleared of thorns.

The area dealt with in the report amounts to 720 acres, exclusive of nearly 2 acres of nursery. This it is proposed to divide into three working-sections. Sections I. and II., amounting to 499½ acres, will be retained as coppice-with-standards. The local demand for underwood warrants the continuance of this system. The crop consists of oak standards with coppice, mainly ash, hazel and sweet chestnut, some birch, hornbeam, etc. Ash and chestnut thrive best, and it is believed will easily attain a height of 25 feet in the fourteen years which have been fixed as the rotation for the underwood. Section III., nearly 221 acres in extent, in which the soil is better than in I. and II., will be converted into high forest. It includes the best standards in the coverts, and in some compartments these are sufficiently numerous to form practically high forest. For this area Mr. Fisher proposes a rotation of 110 years, and the plan arranges for the conversion into high forest at the rate of 2 acres per annum. In order, however, to utilise the underwood to the best advantage, during the next fifteen years 190 acres will continue to be worked as coppice-with-standards. It is proposed to plant the annually-cleared areas with four-year old oak, larch and ash, about 4,000 to the acre. One acre to be planted with 900 oak and 3,100 larch, and the second with the same number of oak, but with ash instead of larch. The larch and ash will provide an early return by the sale of thinnings. Eventually the oaks are to be underplanted with beech.

During the last four years the coverts have yielded a net average return of £188 5s. 9d. exclusive of the shooting rent, £125.

The average annual returns from the woods during the last ten years have been 12s. 10d. (8s. 2d. for standards and 4s. 8d. for the coppice) per acre. Considering that for the first fourteen years the number of standards to be felled will be reduced, Mr. Fisher carefully assumes that during this period even this sum will not be realised. He estimates the annual receipts :—

48 acres coppice-with-standards fellings	...	£400
Clearings, 2 acres at £30 per acre	...	60
Shooting rent	...	125
		—
Adjoining woods attached to the coverts but not included in working plan	...	50
		—
	Total	£635

The management charges amount to £188 per annum, and the purely silvicultural expenditure has been estimated at £163 5s. or £164. Mr. Fisher has, however, estimated only £12 5s. for three years' clearings of coppice shoots at 5s. per acre over 49 acres; this should be £36, and the total expenditure £187 15s. The balance will be £259. With the improved treatment now prescribed there is no doubt the revenue from the coverts will be greatly increased eventually. The quality and quantity of the underwood will increase in Sections I. and II., and in Section III. the oak timber should realise £4 to £4 10s. per acre, instead of 12s. 10d. There is a printer's error on page 35, where £281 should read £283, or, according to the correction just made, £259.

E. P. P.

EVELYN'S "SYLVA."*

WHEN Evelyn's "Sylva" was published in 1664, the country was recovering from the disorders of the Civil War, and a great impetus was given to planting by owners of large estates. The finest existing example of planting done by Evelyn is the grand elm avenue in the Broad Walk, Windsor Park, the stately trees in which are now being replaced gradually, though many of them are still in good

* "Sylva, a discourse on Forest Trees," by John Evelyn, F.R.S., with an essay on the life and works of the author, by John Nisbet, D.CEc. A reprint of the 4th edition, in two volumes. London. Published by Arthur Doubleday & Co., at 8, York Buildings, Adelphi. 1908. Price 21s.

condition. The republication in 1812 of the "Sylva" with notes, by Dr. A. Hunter, F.R.S., revived the ardour for arboriculture of Charles II.'s time, "while forests were laid prostrate to protect ourselves from the insults of the enemy, the nobility and gentry began once more to sow the seeds of future navies." The extensive cultivation of larch was fostered by Dr. Hunter's edition of the "Sylva," and owners of small estates now begun to plant trees, while £300,000 were voted by Parliament, to plant oak and conifers in the Crown Forests. Now again has come a period, when a world timber-famine is looming in the near future, and there is, throughout the British Islands, a strong feeling that all our lands, that are unfit for agriculture and yet capable of producing timber, should be converted into woodland, which is more valuable than rabbits. Many large municipalities, Liverpool, Manchester, Leeds, Birmingham and Bury are planting municipal lands, and their example will lead to more municipal planting, while extensive action by the State, in this direction, cannot be long delayed and is already imminent in Ireland.

Dr. J. Nisbet's new edition of the "Sylva" has therefore appeared at a most propitious time. It includes a portrait of Evelyn, and an excellent account of his life and works. Nisbet, whose excellent little book, "Our Forests and Woodlands," as well as his larger work "The Forester," and some other useful books on forestry, gained the Kaisar-i-Hind medal from the Government of India for his book on Burma, and is an able and experienced literary and scientific writer.

John Bunyan, John Evelyn, Isaac Walton, and Samuel Pepys are the most popular writers of the Restoration period. Nisbet traces the friendship between Pepys and Evelyn from their diaries, and states that "no one knew Evelyn so well as did Pepys"; the two men were great friends and very patriotic Englishmen, both remaining at their posts in London during the Great Plague, Evelyn as Commissioner for the care of the Dutch prisoners of war, and Pepys as Secretary to the Admiralty. When Pepys died, Evelyn ordered a complete suit of mourning, and refrained from acting as one of his friend's pall-bearers only on account of his own bad health at the time.

The essential facts of Evelyn's life are set forth in his diary, which he kept from the age of eleven, till within one month of his death; the published diary, however, being compiled by himself from the rough one, he wrote up daily. He was born at Wotton, on Leith Hill, Surrey, in 1620, of an ancient and honourable family. He was the second son of his father, who served as High Sheriff for Surrey and Sussex combined, and who had, at Wotton, an estate bringing in £4,000 a year, well-wooded and full of timber. When sixteen years old Evelyn became a fellow-commoner at Balliol College, but he took no degree at Oxford, though in 1669, when he had become famous, his university conferred on him the degree of honorary D.C.L. He went into residence at the Middle Temple in 1639. When in Holland in 1641, he served as a volunteer in the Queen of Bohemia's army, but he had very little taste for soldiering, and returned to England for his twenty-first birthday. He joined the King's army, and fought against the Parliament at Braineford, but being solicitous about his brother's estate and his own property, he returned to London, and stated "that nobody knew that he had been in the King's army." He travelled in France and Italy from 1643 to 1647, and studied gardening there, catching small-pox in a curious way, as is related by Nisbet. In Paris, in 1647, he married a daughter of Sir Richard Browne, his Majesty's Resident at the Court of France; she was, however, only twelve years old, and he left her with her parents till she was sixteen. This lady survived her husband by three years, and died in 1709, retaining to the last her love and affection for him to whom her destiny had been entrusted when she was a mere child.

Evelyn returned to England in 1647, and lived at Sayes Court, near Deptford, that belonged to his father-in-law, and where he studied chemistry. Sayes Court was confiscated by the Parliamentarians, but Evelyn purchased it for £3,000. He gardened and planted trees there on a large scale. Here, in 1698, Peter the Great lived and ravaged the gardens and hedges so that Evelyn was paid as compensation £162, the estimate of the damage done being made by Sir Christopher Wren. Until the Restoration, Evelyn lived quietly at Sayes Court, spending his time in gardening and in the society of

men of cultured tastes, and he then visited many parts of England. He published several literary works, an account of which is given by Nisbet, one of them, *Fumigium*, is a complaint against London smoke, and he proposes "that by an Act of the present Parliament, this infernal nuisance should be remedied." This was, however, after the Restoration; his only important work written during the Commonwealth being "The French Gardener," a translation of a book by N. de Bonnefons. After the Restoration he was one of the most prominent original Fellows of the Royal Society, of which he was elected president in 1690 and again in 1693, but he refused to accept that honourable post.

In 1662, Evelyn was appointed Commissioner for reforming buildings, wayes, streets and incumbrances, and for regulating hackney coaches in London. He proposed to remove the objectionable cottages that, during the Commonwealth, had been erected in the fields to the east of Whitehall, where he proposed to build a garden city, planted with trees and shrubs and adorned with flower-beds. The planting of the lime trees in St. James' Park is said to be due to him, and he was amazed "that the sordid avarice of some few particular persons should be suffered to prejudice the health and felicity of so many, and that men, whose very being is air, should not be allowed to breathe it freely." After the Great Fire he, like Wren and Hooke, submitted a scheme for the rebuilding of London, on an improved plan, but the new city was formed mainly on the old lines.

In 1664, Evelyn obtained a salary of £1,200 a year, as Commissioner for the care of the sick and wounded Dutch prisoners, in our war with Holland. He then wrote the "Sylva," which by the time of his death had gone through four editions, though it brought no pecuniary profit to himself, the copyright having been given by him to the Royal Society's printers. A fifth edition appeared in 1729, and four other editions, with notes by Dr. Hunter, from 1776 to 1812, and another in 1825; and in 1827, John Mitchell, an agriculturist, published "*Dendrologia*, a treatise on forest trees, with Evelyn's *Sylva*," which Nisbet stigmatises as so much bombastic language and buffoonery. The present edition is,

therefore, the twelfth that has appeared of Evelyn's great work.

Chelsea College had been presented to the Royal Society by Charles II., but Evelyn took a prominent part in purchasing and endowing it with an income of £5,000 a year, as a hospital for old soldiers. In 1671, Charles II. put Evelyn on the Council for Foreign Plantations (Colonies). Evelyn opposed the Romanising policy of James II., and supported William of Orange, and in 1695 became Treasurer of Greenwich Hospital for decayed sailors. He died at the advanced age of eighty-five, and was laid to rest in Wotton church. On the death of his elder brother in 1699, he had succeeded to the family estate at Wotton, which his descendants still retain. In a corrupt and profligate age, Evelyn's character stands out unsullied by excesses or vices, and he was tolerant to those whose religious views differed from his own.

The "Sylva" is a vast work and contains much that is still interesting and useful as regards arboriculture, though Evelyn knew nothing about silviculture. The book is too well known for there being any need to describe its contents here. The library of every one who loves British woodlands should contain a copy of this classic work, and the present edition stands unrivalled, being beautifully printed in large, clear type, and on light unsized paper, so that it is a pleasure to handle the volumes. It is much more legible than the older editions, that have interest mostly for bibliophiles, but are generally very difficult to read. It is not, like Dr. Hunter's editions, combined with extraneous notes—only Evelyn's text being given. Dr. Nisbet and his publishers are to be congratulated on having executed an excellent and well-timed work in supplying foresters with this fine edition of the "Sylva."

CONNOLD'S "BRITISH OAK GALLS."*

THIS beautifully illustrated book is a sequel to "British Vegetable Galls," a larger and more artistic work, also by E. T. Connold, published by Hutchinson & Co., of Paternoster Row, in 1901.

The British oak is the abode of a vast concourse of dependents; nearly five hundred different species of insects and other creatures find their needs supplied, mainly by the leaves. Of this number about two hundred are either parasites living on the fifty-four species of *Cynipidae* that produce galls, or are *Inquilines*, obtaining their nourishment from the tissue of the galls. The object of the volume is to describe and illustrate galls produced by *Cynipidae* and other causes of galls. Mr. Connold will esteem it a pleasure to endeavour to identify any galls, specimens of which should be sent to him in a tin box. Due acknowledgment is made to several people, including Mrs. Connold, who have helped him in this very entertaining study. Besides the *Cynipidae*, which are hymenopterous insects, a few flies, one species of *Coccus* and one fungus cause oak galls. The fungus is *Dichæna quercina* Fries, and is common on stunted oaks by the roadside; it causes a number of solid, hard spheroidal swellings, and probably lives for a number of years without causing any serious physiological injury; the fruiting stage of this fungus is rarely seen, and in some species is not known. There is a fungus (*Dathivora sphaeroides*), which causes globular swellings on ash saplings, that thus form valuable walking sticks and umbrella handles, and similar knobs occur on oak and sweet chestnut saplings, that are very common in the Bagshot sand district in Surrey. It would be interesting to know if these are really due to *Dichæna* or not. The author states that the Turkey oak is often free from galls, even when growing side by side with *Quercus pedunculata*, which is covered with them. He adopts the opinion, which is the correct one, that *Quercus sessiliflora* is a distinct species, but has not adopted Sir Herbert Maxwell's view that the sessile oak is less liable

* "British Oak Galls," by E. T. Connold, F.L.S., F.E.S. Pages i-xviii., 169, including index. 17 figures in text, 21 insets, and LXVIII. full-page plates, as well as frontispiece. Allard & Sons, Bartholomew Close, 1908.

to galls than is the pedunculate oak. The statement made on page 37 that the bark of oaks is the most valuable part of the tree is certainly incorrect.

Every lover of the country-side should have this book in his library, as well as the larger work of the author on British vegetable galls. It is the result of long and arduous study, and the matter is dealt with in the most complete and scientific manner, while, as already stated, the illustrations are beautifully designed and executed.

Official Papers.

NOTES ON THE PAST AND PRESENT CONDITIONS OF SOME OF THE WOODS AND THE GENERAL PLAN OF MANAGEMENT OF THE HARGHAM ESTATE BELONGING TO SIR H. BEEVOR, BART.*

Plantations on Sandy Soil, 1824, and after.

THE crop of timber is maturing on two-thirds of the area of 220 acres, hence the old system of thinning by a ten-year rotation is not called for, and instead, a system of felling out and replanting has been adopted.

The amount of the annual yield—a yearly increment of roughly 5,000 cubic feet—has been found out by taking a timber survey of the woods. This showed a mean stock of only about 1,000 cubic feet per acre, which, on the average of 200 acres at (?) $2\frac{1}{2}$ per cent. gives 5,000 cubic feet. In the better woods the stock rises to 2,000 cubic feet an acre. It is the thinner woods of mature age with which clearance began seven years ago, in areas of about 4 acres. A smaller area will soon supply the same quantity, and when one comes to $2\frac{1}{2}$ acres annually of 220 acres, the effect will be a rotation of eighty-eight years, which is considered a desirable period. The position must be reviewed by a survey some ten years hence.

* These notes were prepared for a meeting of the Norfolk members of the R.E.A.S. in August, 1908.

The kind of crop planted by Sir T. B. Beevor has varied in accordance with the quality of the soil, and will probably be on the whole closely followed, but, as may be seen, every replanting is an experiment, which will also determine the course to be pursued.

While the old crop was planted by the aid of trenching 18 inches and crops of carrots, the replanting has to follow a different course, attempting to keep the expenses of plants, nursery-planting, wire-netting and cleaning, within £10 an acre.

Oaks Close—Planted 1825. (Planted in groups.)

Av. size
cub. ft.

35	The best oak mounts to 2,100 cubic feet to the acre.
50	Beech generally ... 2,700 " "
38	Chestnut, thin from frequent windfalls.
60	Larch.
26	Ash—(probably planted by pitting).
Larch among beech. Felled chestnut and their utility.	
Trial replanting of a cleared acre. Evidence of shade and shelter effect. Alder planting.	

Leys Plantation.

1,300 cubic feet an acre of oak, ash, larch and beech, mostly in groups, has just been removed, the area wired in, and the sandy hill planted. The bracken undergrowth has been cut now five years. Larch and hardwood in equal quantities planted in December, 1902—1904, in pits 4 feet apart. It must be termed a failure on all but the lower ground. Exposure and the growth of Yorkshire fog-grass, which dominates the soil and abstracts the scanty moisture, appear to be main cause of failure.

The success in mending with Corsican pine, and the death of natural seedlings. Suggestions are invited as to how to proceed with mending. Marketing of recent produce. Measurement of standing ash timber.

Extension of Leys by planting an old fallow. Ploughing to 8 inches and cleaning, 1906.

No losses with the moist summer of 1907, but growth poor this year.

Japanese and European larch compared; absence of all aphis 1908. *Quercus sessiliflora*.

Ash Cover. (Leys.)

Alnus incana. German ash. American larch (*tamarack*). Menzies spruce.

Brickhills Plantation.

A. Planted 1829.	Oak, average measurement ...	35
1,800 c. f. per acre;	Ash " " ...	18
sand to	Larch " " ...	37
brick earth.	Acacia, 1 acre " ...	29
B. Planted 1860; sand.	Larch felled out 1899. No "canker" at this epoch but "pumping," in this case due to <i>Fomes annosus</i> , progressive decay is visible in the young oak, and even hazel. Probably associated with poor quality of old cultivated land, but nevertheless the crop of larch was good. From 1875 to 1900, £307 was realised at auction on 6 acres.	

Suggestions for replanting invited.

? Acacia to act like a clover crop.

King's Hill. (Fen Plantation.)

1826. Showing good growth of larch and beech mixed. Oak, average 40 cubic feet; Beech, 50 cubic feet; Larch, 72 cubic feet.

Old Plantation.

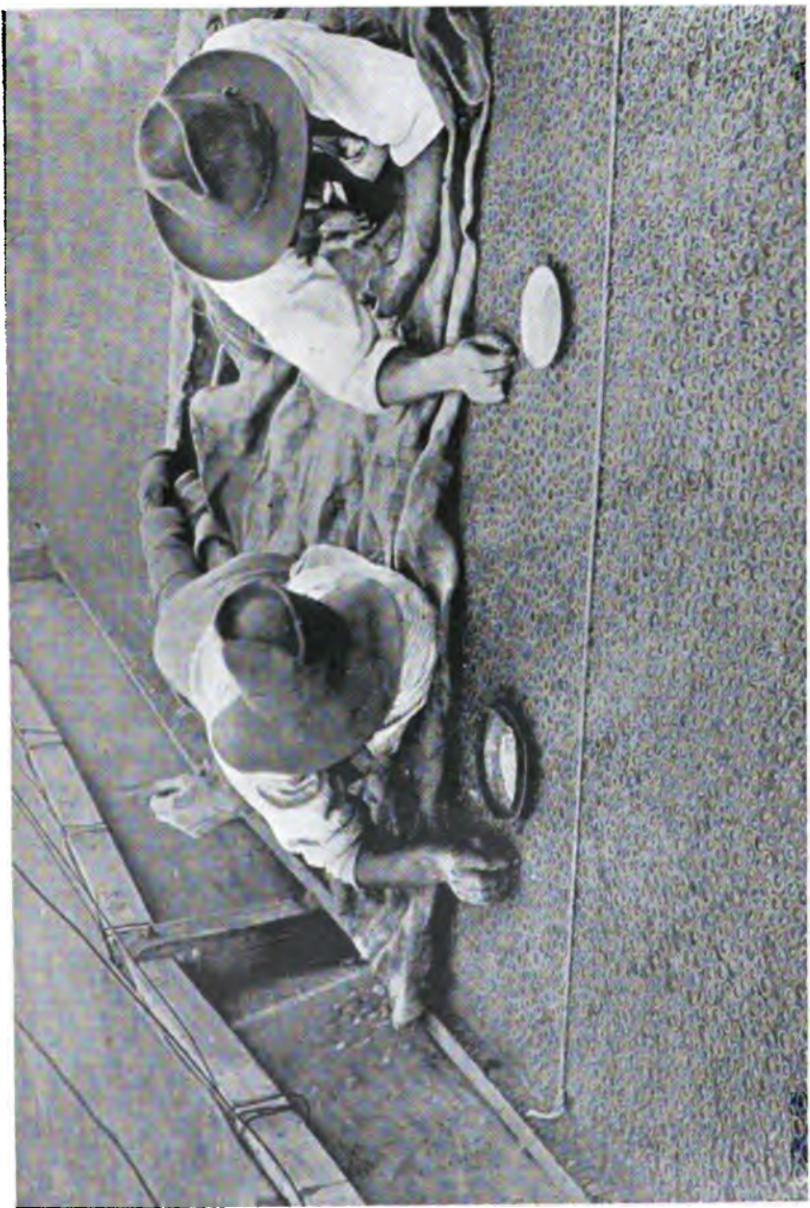
Planted 1829, after a failure of acorn sowing. Natural regeneration of oak started well about 1874, when the keepers' garden stood close by and rabbits were properly destroyed.

Mode of thinning, by leaving the dominated trees for soil preservation.

The Lawn and Meadows.

Recuperation of Wellingtonia. Lime tree seedling. *Libocedrus decurrens*. *Acer opulifolium*.

Ulmus campestris, *U. campestris montana* (Huntingdon), *U. suberosa*, *U. americana*, *U. effusa*, *U. glabra*, *U. stricta*.



W. GILL. Plate IV.—Bundaleer Forest Shadehouse, showing Men Sowing Gum Seed in Tubes. (Vide p. 311.) (Photo.)



The Nursery.

Willows—male—*Pinus Pallasiana* seed beed. *Catalpa speciosa*?

Abies cephalonica, *A. numidica*, *A. Pinsapo*, *Picea orientalis*, *Picea engelmanni*? Elm seedlings (Huntingdon).

The following note on the acacia is appended:—

Robinia Pseudacacia.

It is seldom one sees acacia in the woods, and this must be an excuse for giving a note of my own experience upon the growing of acacia. Firstly there is no demand for it because it is almost unknown, yet it is on the market for the spokes of motor wheels in a semi-manufactured condition, hence a market may be expected; such a use for the wood is sufficient witness of its great strength.

It is not only in strength that the wood excels oak, but further, in two qualities—it is more easily riven, and when used for posts, stakes or sills, is much more durable than oak in contact with the soil. Cobbett quotes evidence of a post at Long Island keeping sound for a hundred years with the lower end in damp soil. The writer is able to send the editor a section from the end of a fence stake, below ground, that has seen service for more than forty years, and is uprooted only to point his argument.

In Brickhills plantation is a plot of acacia grown pure, no doubt under the influence of Cobbett, who had presented his "Woodlands" to the planter, in which work the "Locust" has more space devoted to it than any other tree.

This acre of pure acacia cannot be looked upon as an example for imitation. No tree is more prone to windfall, and there is many a gap. No tree is less inclined to grow a long straight trunk. Moreover, the readiness of cleavage is a character seen again in the woodland, and here with disadvantage where in youth, and later on, there is frequent splitting off of bough and big limbs. However, there is a fair crop of timber left standing on the ground; in size they average at seventy-two years of age only 25 feet cube, which is 20 per cent. less than the oak in the same wood; but the best are

doubtless blown down, and there still stand trees somewhat greater in girth than the largest oak on better soil.

The ground next to this plot was planted thirty years later with larch, oak, and hazel, and the ground was old arable, almost a pure sand; the crop of larch stood thick, disease—*fornes annosus*—was killing them rapidly, so all larch were felled. The ground was pitted for replanting, but there appeared round the sides of most pits ledges of the fructification of fungus, so no planting was done, except some acacia planted in April or May before this evidence of soil permeated with fungus had become so conspicuously apparent. Eight years have elapsed, and one now sees that it is larch first, but not larch only, that are affected, for the oak of forty-eight years old are all full of dead wood and with dying tops, and here and there the hazel die as well. But the eight-year-old acacia form a striking contrast in their luxuriance to the surrounding decay; some girth 14 inches at 5 feet, and are 20 feet high; root-suckers are springing up already, so these trees are in no way checked by the influences so disastrous to their predecessors.

Two features distinguish acacia in silvicultural habit: rapid growth in youth, and liking for a poor sandy soil.

The rapid growth at early age (to-day I measured a tree from sucker twenty-one years old, 25 inches girth, and 42 feet high) calls for felling probably at about forty years old, when growth slackens; and the natural regeneration by suckers is so free that if the exotic-loving rabbit is unknown, the succession is assured.

The liking for a poor soil requires much more attention from the forester to-day, when agricultural science with its recent discoveries can throw light upon the peculiar behaviour of this leguminous tree. As clover and lupins can flourish in a poor soil by reason of their root nodules associated with nitrogen-fixing bacteria, so can the acacia. As we can grow a corn crop with profit after clover and beans, which leave a manurial value behind them, so it is reasonable to expect that with the acacia on poor soil a better class of timber tree can be grown than without it; the roots of the trees removed in thinning will be fertilising the soil if not also the rootlets of the

growing tree. This instance of 'chance planting in ground infected by fungus is, I think, also an example of the utility of the acacia, which may be followed hopefully. While a mycorhiza may be a part of root mechanism in all trees, it is the leguminous tree one would expect to be most likely to revel in the association with nitrogen-fixing fungi too exuberant for other trees.

It is with recent knowledge, then, that we must seek evidence for the use of the acacia in silviculture. I have no experience of the effect of any mixture of the tree myself; this aspect of its culture may be important.

For its own sake I shall continue to grow it for estate use, having always utilised and refused to sell any. The chief use I put it to now is stakes for rabbit-proof fencing, and these stakes I have no doubt when taken up at the end of ten years will be used again for another similar term. To supply stakes no tree is so well fitted, and it would be worth planting if for this purpose only.

H. R. BEEVOR.

THE FORESTRY EXHIBITION AT NEWCASTLE-ON-TYNE.

ALTHOUGH the Forestry Exhibition organised by the Royal English Arboricultural Society in the Royal show grounds at Newcastle occupied practically two-thirds of the building allotted it, little or no room remained over when Mr. Geo. Marshall had completed his arrangement of the entries, while a large number had to be staged in the open air. Since this exhibition was inaugurated at Park Royal, it has been steadily growing in size and increasing in interest, and the exhibits of 1908 left little to be desired in either direction.

The competitive classes for specimens of British timbers were four in number, and of these Class 2 for specimens of larch, spruce, and Scots pine planks brought out seven entries, all of which were of considerable merit. The best of them came from the Earl of Carnarvon, Highclere, consisting of

three very fine, large and clean planks, the Earl of Yarborough and Earl Beauchamp being second and third respectively. The last named obtained the silver medal for oak, elm and ash planks in Class 1, Viscount Ridley being second. The exhibits in this class were also extremely good, proving the high quality of British timber when properly grown. Classes 3 and 4 for miscellaneous specimens were filled with some interesting examples of native and exotic timbers, amongst which were walnut, mountain ash, English maple and service tree (*Sorbus*) from the Marquis of Exeter, and acacia or locust tree, scarlet oak, plane, holly and mulberry, amongst broad-leaved trees, and *Sequoia*, *Cryptomeria*, cedar, Douglas fir, etc. amongst conifers from the Earl of Yarborough, the former group of which obtained first prize in Class 3. In Class 4 the Earl of Carnarvon showed a splendid specimen plank of Weymouth pine, one of the most valuable conifers capable of growing in Britain, but unfortunately liable to wind damage and disease.

Amongst other competitive entries obtaining medals were those of Mr. A. T. Gillanders, consisting of twelve carefully arranged cases of injurious insects; Earl Beauchamp showing specimens of larch grown on various soils and at different elevations, and the Duke of Northumberland, demonstrating the effects of good and bad pruning on various species of broad-leaved trees. In Class 8, for specimens of stems and boards, illustrating the effects of thick and thin stocking in plantations, Lord Yarborough and the Duke of Northumberland both had most instructive specimens, the former showing planks of all the commercial coniferous timbers, and the latter stems from thick and thin crops of Scots pines, spruce, oak and ash. The Earl of Yarborough exhibited the splendid collection of witches'-brooms and burrs, collected by Mr. W. B. Havelock, and taken from twenty different species of trees.

Classes for gates and fencing were well filled, and some useful examples of estate workmanship were exhibited, conspicuous amongst which were the gates from Earl Fitzwilliam, constructed of oak and larch, and a very cheap hunting gate with an ingenious patent fastener from the Duke of Northum-

berland. The Earl of Yarborough showed types of fencing constructed of home-grown creosoted timber and wire, a feature in which were Messrs. Main & Co.'s Springbok roppers, by means of which a wire fence can be kept in shape very efficiently. Earl Fitzwilliam also showed a good collection of creosoted fencing, gates, tree-guards, etc., made from home-grown timber, demonstrating the great value of creosoting on estates where coniferous timber is plentiful but often unsaleable at a remunerative price.

In the sections for exhibition only, a large number of interesting specimens were on view. These included botanical specimens, photographs, etc., from the Armstrong College, *per* Mr. J. F. Annand, together with specimens of home-grown and foreign timbers. Tables of tree planting and the result of creosoting, and photographs of plantations at Brocklesby were shown by the Earl of Yarborough, and plans of woods by the Armstrong College and the Duke of Northumberland. From Brocklesby also came the splendid collection of home-grown timbers which Mr. Havelock has been collecting for many years. This collection now contains planks and hand specimens of practically every species producing timber in the British Isles, numbering 171 in all, of which eighty-three were shown as boards 7 feet in length. The Earls of Egerton and Fitzwilliam also exhibited planks of various home-grown woods. Professor Potter staged a number of fruits of various fungi producing decay in timber, and a neatly arranged collection of tree fruits were shown by Mr. John Patten, jun., of Alnwick.

Outside the building, the most noteworthy exhibit was a plot of ground prepared by Mr. A. T. Gillanders to illustrate the progressive stages of a Scots pine plantation from the beginning to the end of a rotation of 80 to 100 years. Young trees up to twenty-five years of age were shown entire, and the actual stumps of later stages were placed in their usual positions, while the surface of each section was covered with its natural herbage of grass and heather, or a layer of dead needles, according to the age-class represented. Plots were also shown to demonstrate the beneficial effect of grazing by sheep and cattle upon land recently cleared of pine timber, and which

carries a thick growth of grass and heather. Mr. Gillanders' system is that of erecting a cheap fence round the cleared area, and grazing with the heaviest head of stock possible for about two years. At the end of that period, the needles and bark scales of the old crop have been trodden into the ground and converted into vegetable mould or humus, while the surface is covered with a short growth of grass and heather into which three-year-old Scots pine can be slitted or notched easily. A further advantage attending this system is that the interval between clearing and replanting is sufficient to get rid of the majority of the pine-weevils, which have bred in the stumps of the old crop, and which would otherwise do great damage to the young trees. Printed explanations of each plot in this exhibit were placed in front, and the whole idea was capitally carried out.

Another good exhibit from Alnwick was a number of samples and diagrams illustrating the process of creosoting timber, and a somewhat similar exhibit was shown by Mr. Havelock, from Brocklesby, the latter consisting of specimens of twenty-six species treated under high pressure, accompanied by a statement showing the amount of oil absorbed by each species per cubic foot. Posts and rails which had been in use from nine to eleven years were also shown in the treated and untreated condition.

Growing seedlings and plants were shown by Messrs. Backhouse, Little and Ballantyne, Joseph Robson & Sons, Richard Smith & Co., etc. A fine collection of seedlings in pots, consisting entirely of conifers, came from Mr. C. J. Leyland, of Haggerston Castle, and an interesting set of one-year seedlings of various kinds from Messrs. John Robson & Son, of Hexham. This firm's exhibit of trees and shrubs for seaside, town, and inland planting was partly surrounded by a fine hedge of *Olearia hastii*, a stiff, hardy shrub which appears well adapted for low shelter screens near the sea.

Amongst miscellaneous exhibits were two sections of Scots pine shown by Mr. Geo. Marshall, one grown in Norway and the other in Britain, and illustrating the comparative rates of growth under different climatic conditions. Mr. J. F. Annand also had photographs of measured sample plots of timber in

the north of England, with details of volume, soil, situation, etc.

The exhibit was well attended all through the show, and was visited by their Royal Highnesses the Prince and Princess of Wales, both of whom evinced the greatest interest in the special features pointed out to them by Mr. Marshall.

A. C. FORBES.

THE ROYAL ENGLISH ARBORICULTURAL SOCIETY.

ON Saturday, August 8th, the Twenty-seventh Annual General Meeting of the Society was held in the Liverpool Street Hotel, London, the President, Mr. H. J. Elwes, F.R.S., in the chair. There was a good attendance. The report of membership gave satisfaction, there being a total of 1,031, which shows a great increase for the year. The statement of the Society's finances was also satisfactory, though it is anticipated that during the present year, when full advantage will be derived from the recently elected new members, the Society's position will be much improved. The income during the year, including a balance in hand brought forward, amounted to £744 5s. 3d., and the expenditure £443 18s. 10d., leaving a balance in hand on the current account of £300 6s. 5d. The election of officers was next proceeded with, and Mr. Elwes, the retiring President, moved the election of Sir Hugh Beevor, Bart., which was carried with great acclamation. Sir Hugh Beevor suitably responded. The remaining officers were re-elected, Dr. Augustine Henry being elected a Vice-President in place of Mr. B. Cowan, deceased, and Mr. George Cooper an Auditor. Only one essay was sent in for competition, this being by Mr. B. W. Adkin, of 82, Victoria Street, Westminster, on "Butterflies and large Moths affecting Forestry in Britain," which was awarded the Society's silver medal. In the election of local Secretaries a new departure was made, which is calculated to have a far-reaching effect on the progress of the Society. On the motion of Mr. Robert Gray, of Sherborne, it was agreed to ask each county to appoint a local Secretary. In counties

where no action is taken, the Council have the power to appoint a local Secretary. This step must be considered a wise one, and ought to be the means of making the Society more widely known in districts where, at present, the membership is not large. Local meetings are to be encouraged, and in this respect the new President has led the way, for already members in Norfolk have visited his estate at Horgham. A full report of the proceedings of the annual meeting, with list of members, financial statement, etc., will be published in the "Transactions" as usual in December.

At the conclusion of the annual meeting forty-six members left London for Denmark, via Harwich and Erbjerg, to visit the woods there.

The programme had been arranged by Mr. Elwes in conjunction with the Danish Consul, and proved to be of a highly interesting character. Visits were paid to private and State forests, and the tour extended from Monday, August 10th, to Friday, the 14th, inclusive. In addition to the forests, members paid visits to several of the co-operative dairy stores. A full account of the Society's visit will appear in the January number of the journal.

ACORNS FOR DENMARK.

IT is requested that those members of the society who during the trip to Denmark promised to send acorns to the Danish foresters, will either do so direct, and inform the secretary, or send to him as soon as ripe, at least a bushel of dry acorns from selected trees.

Mr. Mündt has kindly promised to receive and distribute them among the foresters to whom we are so much indebted. His address is "Mr. Skovrider Mündt, Sorö, Denmark."

H. J. ELWES.

SEEDS OF PALM.

MR. A. SMYTHIES, of Dolton, North Devon, has seeds of a palm (*Livistona sp.*) growing at 7,000 feet in the N.W. Himalayas for disposal gratis, which he will be glad to send to any applicant.

Current Topics and Short Notes.

Mr. Hoffmann has been appointed *Directeur des Eaux et Forêts* in Belgium in succession to the late Mr. Dubois.

No Government action has as yet been taken regarding the report of the Committee on Irish Afforestation. It is believed that joint action on this report and on that by the Royal Commission on Erosion and on the relation of Afforestation to unemployment will eventually be taken.

The report of the Committee on the appointment of probationers for the Indian Forest Service has not been published as yet, but it is expected that the orders of the Secretary of State for India on this subject will be out soon. Meanwhile the following forest probationers have been selected to study at the University of Oxford :

Name.	School.	University (if any).
Beeson, C. F.	Oxford High School	Oxford (Non-collegiate)
1. Bourne, R.	Clifton	Nil.
2. Brooks, J. B.	Marlborough	Nil.
3. Clifford, M. W.	Clifton	Lincoln College, Oxford
4. Cooper, G. M.	Durham School	Nil.
5. Gent, J. R. P.	Durham School	Worcester College, Oxford
6. Hargreaves, C. K.	Shrewsbury	Nil.
7. Kennedy, W. A.	Edinburgh High School	Edinburgh University
8. MacKarness, C. G. M.	Radley	Nil.
9. Marriott, R. G.	Radley	Hertford College, Oxford
10. Milne, W. C.	Aberdeen Grammar School	Aberdeen
11. Patterson, C. B.	Bedford Grammar School	Keble College, Oxford
12. Stayte, H. W.	Perse Grammar School	Clare College, Cambs.
13. Thomas, A. R.	Felsted	Merton College, Oxford
14. Austen, S. F.	Magdalen College School, Oxford	St. John's College, Oxford
15. Harris, T. A.	Warwick School and University College, Bristol	Nil.
16. Madan, F. R.	Elphinstone College, Bombay	Nil.
<i>Selected for the Ceylon Forest Service.</i>		
1. Inder, R. W.	Kendal Grammar School	Downing College, Cambridge
2. Jones, O.	Kingswood School, Bath	Oxford (Non-collegiate)

Purchase of Woods by the Irish Department of Agriculture.—During the present year, the Department of Agriculture have purchased from the Estates Commissioners the woods attached to the de Montalt estate at Dundrum, co. Tipperary. These woods extend to over 1,200 acres, and contain one of the largest individual blocks of timber in the country. The present stock of timber consists principally of oak, spruce, ash and Scots pine, all more or less mature, and it is intended to clear and replant the ground gradually, and convert the timber in a sawmill on the estate.

The Department have also purchased 600 acres of woodland in the Camolin estate, co. Wexford, which contain some fine larch and Scots pine timber, together with beech and oak.

These woods will be worked in connection with the Forestry School at Avondale, co. Wicklow, and arrangements are being made on both estates for the accommodation of students.

A. C. F.

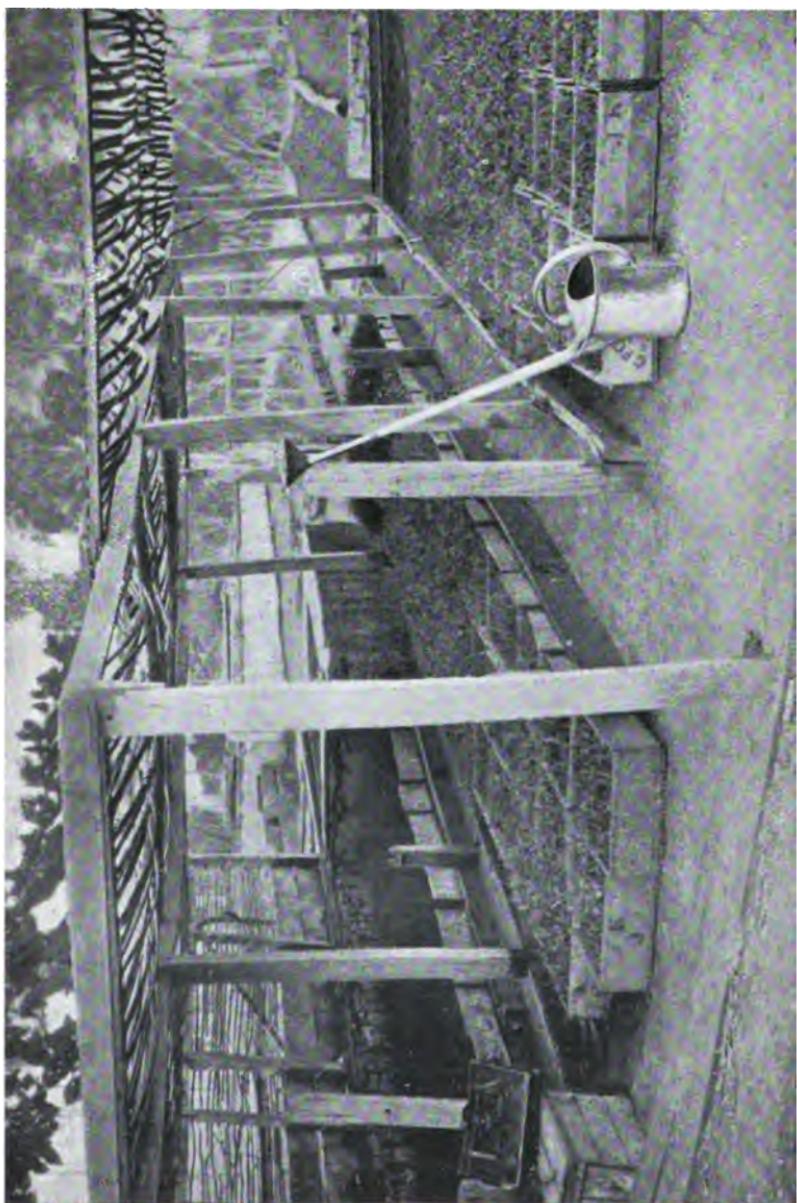
Chestnut Coppice, near Paris.—Mr. P. M. Leddet, the inspector of forests at Versailles, has, at the suggestion of his brother, Mr. L. J. M. Leddet, who attended the annual tour of the R.E.A.S. in Gloucestershire last year, sent the following statement of the yield of sweet chestnut coppice near Paris.

There are in the *inspection* of Versailles 25,000 acres of chestnut coppice, 7,500 being under State control, and the rest being privately managed. The rotations adopted by the State are twenty-five to thirty years, and eight to fifteen years by private owners.

The yield per acre is as follows :—

	Timber. Cubic feet.	Firewood. Cubic feet.	Faggots. No.
12 years' rotation —	280	700	560
25 " "	1,680	520	400
30 " "	2,100	520	320

As the cubic feet are measured for stacked timber and firewood, one quarter may be deducted from the yield of timber





and one half for the firewood, in order to arrive at the solid cubic feet of each category.

The smaller chestnut poles are used as follows :—

Fencing stakes	...	...	...	5—10	feet long.
Split laths for palings	...	...	3—6	"	"
Vine props	...	...	3½—5	"	"
Roofing laths	...	...	4½	"	"
Hoopwood	...	...	...	small poles.	

The larger poles are sawn into planks for parquets and furniture. At twenty-five years the crop is sold standing for about £17 10s. per acre, and, in exceptionally good crops, for £24. A crop thirty years old is sold standing at from £24 to £36. Chestnut trees above 3½ feet in girth at chest height are sold at 8d. to 10d. a cubic foot, in proportion to their size. Trees above 5½ feet in girth are generally shaky and fit for fuel only.

Forestry in South Australia.—The following extract from the Report by Mr. W. Gill, Conservator of Forests for 1904-5, of the South Australian State Forest Administration, explains our plates II., III., IV., and V.

Photographs in the appendix give a good idea of the operations in the nursery at Bundaleer, one of the principal centres of distribution. Plate II. shows the shadehouses there with two beds of tubes "plunged," or placed ready for sowing gum seeds. These tubes, commonly called bamboo, are cut from the large reed (*Arundo donax*), which is extensively grown by the department for this purpose. Plate III. shows a closer view of a section of the beds. Plate IV. gives an illustration of the way the seed is sown, and Plate V. shows seedling gums in boxes. Bamboo tubes similar to these are used in the Himalayas in planting Deodar; in hot countries planting is often very difficult and such precautions must be taken to ensure success. Some similar plant might be useful for Corsican pine, and especially for Black walnut in this country, where, for most species, planting is an easy matter.

Sequoia Wellingtonia Felled at Brocklesby Park in August, 1908.—The following account of a fine tree which has died this summer, apparently from an attack of *Agaricus melleus*, may be of interest. Symptoms of decay were first noticed in June of this year, and afterwards the foliage rapidly withered. It stood in a clump of *Tsuga canadensis*, with an undergrowth of *Rhododendron ponticum*, in a sheltered position, surrounded by old timber. From the annual rings its age appeared to be forty-one years, and it must have been one of the earliest planted in this country, as the first seeds were only sent from California in 1853—fifty-five years ago—by W. Lobb. The soil is a deep, moist sandy loam overlying chalk, and no doubt this, combined with the shelter obtained from the surrounding timber, accounts for its rapid growth of 2 feet in height and $2\frac{1}{2}$ cubic feet in volume for each of the forty-one years of its existence. It should be added that another Wellingtonia, growing not many yards distant from the above, was felled four years ago, which had also been attacked by this fatal disease.

Total height, 80 feet.

Length of bole, cut off at 7 inches quarter girth, 63 feet.

Cubical contents, 63 feet by $14\frac{1}{4}$ inches quarter girth, 88 feet.

Cross-section of root-end = 5 feet by 4 feet 4 inches.

Distance from root end. Feet.	Diameter in Inches.	Age by Annual Rings. Years.	Annual Rings of		Diameter of Heart Wood. Inches.	Remarks.
			Sap Wood.	Heart Wood.		
At root	36	41	13	28	22	One straight crack across root end, extended about 4 ft. upwards; otherwise perfectly sound.
8 ft.	25	37	13	24	17	
16 "	22	35	14	21	13	
24 "	19	32	14	18	11 $\frac{1}{2}$	
32 "	17	29	17	12	8 $\frac{1}{2}$	
40 "	14	25	17	8	6	
48 "	11	22	16	6	3 $\frac{1}{2}$	
56 "	9	19	16	3	1	
63 "	7	13	11	2	—	

Maraby Woods, North Lincolnshire.—PARTICULARS OF TOTAL CLEARANCE OF THREE ACRES OF CONIFEROUS TIMBER, FORTY-FIVE YEARS OLD.—The timber was felled, dragged into lots, and then sold by auction on July 29th, 1908. In measuring the timber, 1 inch in 12 was allowed for bark. Following are details of timber sold, with prices realised:—

			ft.	s.	d.	£	s.	d.
342 Larch	...	...	3,460	ft.	at 10d.	...	...	164 5 0
42 Corsican Pine	...	635	..	6½d.	...	...	16	12 6
28 Spruce	...	106	..	5d.	...	...	2	3 6
28 Sycamore	...	277	..	1½d.	...	...	12	17 6
59 Birch	...	206	..	8d.	...	...	7	2 6
13 Oak	...	33	..	9d.	...	...	1	5 0
20 Lime	...	217	..	9d.	...	...	8	2 6
5 Ash	...	33	..	1s. 2½d.	...	...	2	0 0
82 Various poles	...	150	..	7d.	...	...	4	10 0
Sundry timber sold privately	...	...	...	...	...	...	3	9 2
Firewood sold	...	...	...	...	...	...	2	13 0
200 ft. Larch for estate use	...	...	...	...	...	...	9	3 4
							234	4 0
<i>Deduct expenses as follows:—</i>								
Cost of labour in felling, lutting, measuring, etc.	...	...		16	18 11			
Auctioneer's fee, printing, advertising, etc.	...	...		7	5 1			
							24	4 0
<i>£70 per acre</i>	...	...	...	...	...	...	£210	0 0

The soil is a poorish sandy loam, formerly under cultivation. A farmer who was present at the sale, and bought several lots, told how he had harvested barley on the ground just before it was planted. Ten shillings per acre, at most, would be its full agricultural value, and taking this as a basis, the returns work out as follows:—

	£	s.	d.
3 acres at 10s. per acre rent, accumulating for 45 years at 2½ per cent. compound interest	...	122	5 0
Ditto at 10s. per acre, estimated cost of planting for 45 years, at 2½ per cent.	...	45	9 0
	£167	14	0

Deduct this from £210, the net return from the three acres, and there is left £42 6s., or £14 2s. per acre, which represents the profit for the whole period of forty-five years. It may be pointed out that nothing has been allowed for value of the wood for sporting purposes.

It is assumed that the value of the thinnings taken out at various times would pay for all expenses incurred in the upkeep of the wood, fences, rates, etc.

It is worth noticing that the Corsican pine average 15 feet per tree, as compared with 10 feet average of the larch, and were well-grown and perfectly sound. The timber merchants did not seem to know much about the qualities of this pine, and bid with considerable hesitation. The wood adjoined a good road, three miles from the nearest station. The ground on the west side had been cleared last year, and several of the trees in the area under discussion had been blown down, so it was decided to clear it, although it could not be said to have reached maturity.

W. B. HAVELOCK.

PROFESSOR BOULGER sends the following remarks on the review of his book on "Wood" in our July number:—

P. 124. "Ah-pill." Statements almost entirely based on F. M. Bailey's Catalogue of Queensland Timbers in the Colonial Exhibition, 1886. Such woods may come into our commerce, and I hope my book may have some sale in Australia.

P. 125. American Alder, *Alnus incana*. No doubt an error in nomenclature; but taken almost *ipsissimis verbis* from F. B. Hough's "Elements of Forestry," p. 233.

P. 129. I much regret that the slightness of my connection with the trade and of my sources of Japanese information made me omit *Acanthopanax*.

P. 63, ll. 126—132. I do attempt an enumeration of the causes of burrs.

P. 85. The statement as to the use of yew at High Wycombe may be no longer true. It occurs in Stevenson. Had I given references for each statement in my book it would have enhanced its size and price enormously.

Pp. 99 and 280. Mr. Elwes' comments seem to me hardly fair. I cannot be said to dismiss the timber supply of Asia in ten lines because my first paragraph happens to be of that length. Another deals with Japan, a third with India, a fourth with Further India, and a fifth with the Philippines. As to *Cryptomeria*, Mr. Elwes calls it "the most abundant and valuable timber-tree" of Japan, and adds that "on p. 280 it is said to be 'used for common lacquer-ware,' and that is all,"

whereas I give its native name, altitude, measurements, colour, etc., and add "one of the most abundant and useful of Japanese forest-trees." (!)

P. 36. I cannot say at the moment the exact sources of my note on the four varieties of *Robinia* wood. It certainly refers to the wood in its native country, and, speaking from memory, I think it is based on something in Loudon's "Arboretum."

Orham-wood. Mr. Elwes says, "No mention is made of . . . *Orham-wood*"; but see p. 236, which is duly referred to in the index.

Taxodium. My "very misleading and quite inaccurate remark" on this wood is a literal quotation from Bulletin 38 of the United States Bureau of Forestry.

SALES OF TIMBER.

Bolton Abbey and District.—There has not been much timber felled in this district this year. There were a few small lots in the early part which made prices much as usual. The following lots were all felled by the purchaser, and all measured over bark, no allowance made except for shaken and rotten-ended trees.

Name of tree.	Quality.	Price per cube ft.	Remarks.
Beech ...	Good	1s.	
Sycamore	"	"	
Elm ...	"	"	
Ash ...	Black-hearted	"	
Oak ...	Good	"	
Sycamore	"	1 <i>1</i> d.	
Beech ...	"	"	
Ash ...	Black-hearted	"	
Elm ...	Shaken	"	
Larch ...	Good	"	
Larch ...	Very fair	1 <i>0</i> d.	5 miles from a station, and hilly road.
Scotch ...	"	3 <i>d</i> .	
Spruce ...	Rough	"	
Sycamore	Fair	7 <i>d</i> .	8 inches quarter-girth : had all to be blocked out of the wood ; 3 miles from a railway-station.
Elm ...	"	"	
Alder ...	"	"	

BOLTON ABBEY,
September 14th, 1908.

J. MITCHELL.

LIST OF BOOKS, JOURNALS, AND PAMPHLETS RECEIVED, ANNOUNCED, OR NOTED.

A second edition of Schlich's Manual of Forestry, Vol. V., "Forest Utilization," by W. R. Fisher, with much new matter and many new illustrations, will be published on the 1st October, 1908, by Bradbury, Agnew, & Co., Bouverie Street, London.

"Working-plan for Chopwell Woods," with maps, by J. F. Annand. Andrew Reid & Co., Newcastle-on-Tyne. 1908.

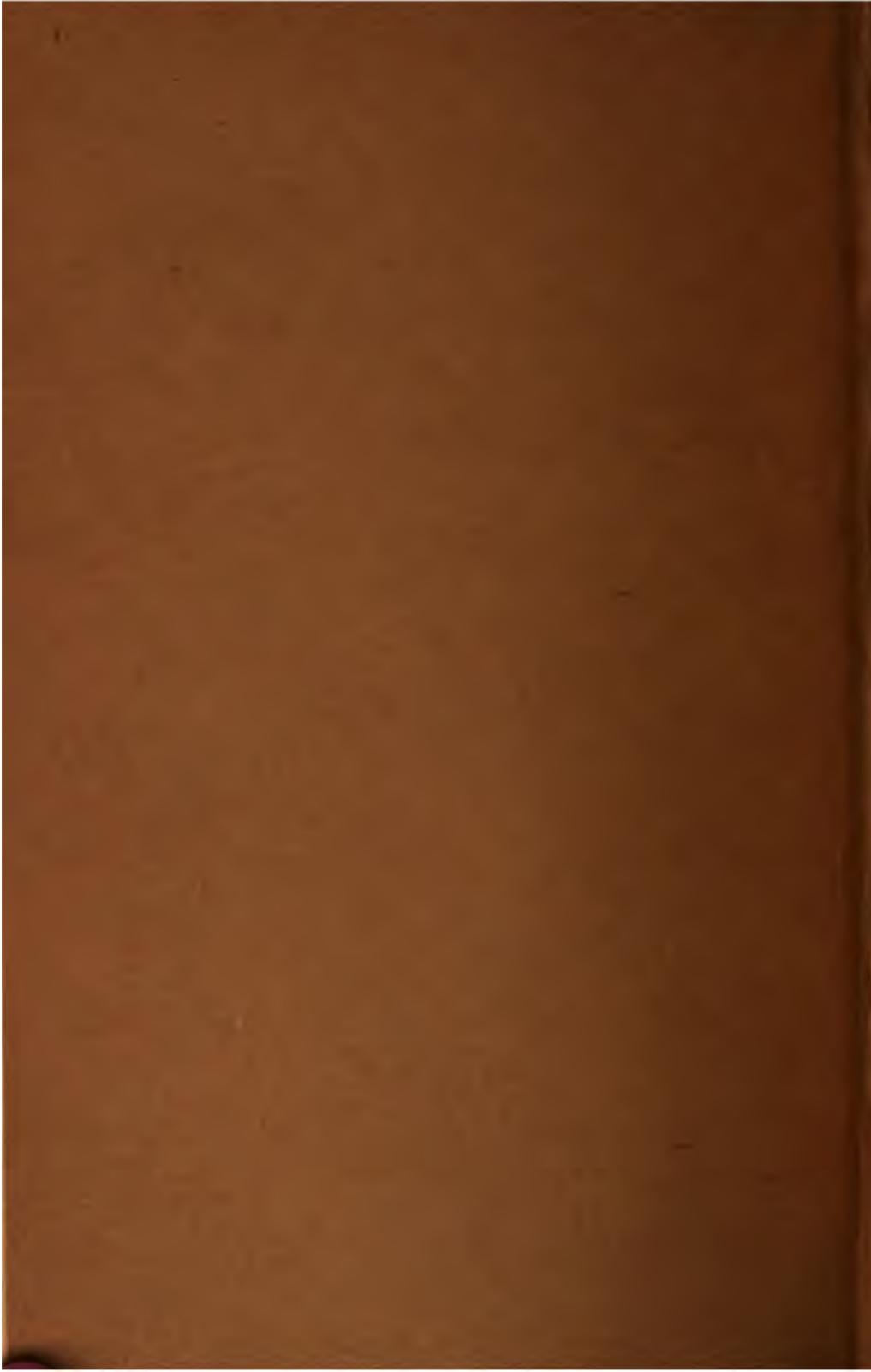
The following books have just reached us from the Government Press, Calcutta:

"A Concise Manual of Silviculture for the use of Forestry Students in India," compiled from Schlich's Manual of Forestry, Vol. II., Gamble's Indian Timbers, Hall's Soils, and Boppe's Silviculture. The name of the author is not given.

Also "A Manual of Forest Law," compiled for the use of students at the Imperial Forest College, Dehra Dun. This book has no preface, and no author's name is given. They can be obtained from E. A. Arnold, 41, Maddox Street, Bond Street, London, W., the price being 2s. 4d. and 1s. 6d. respectively.

Current Nos. of the following magazines are acknowledged: Bulletin de la Société Centrale Forestière de Belgique. Revue des Eaux et Forêts. Bulletin de la Société Forestière de Franche Comté et Belfort. Swedish Journal of Forestry. Scopvärs Föreninge Tidskrift. Indian Forester. It is hoped in the January No. to give a short account of the contents of these forestry magazines.

Mr. J. Demorlaine, *Inspecteur adjoint des Forêts*, at Abbeville, Somme, has sent his book "Sylviculture," one of a series, entitled, "Aide-Mémoire du Forestier," published for the Société Forestière de Franche Comté et de Belfort, by Jacquin of Bésancon. 1907.





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